NOV 7 1930

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN U

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SEE PAGE 895

From below freezing to almost boiling in 5 minutes!

It takes "double-range" Mobiloil to protect your engine from this gruelling winter wear.

These extremes of temperature require your oil to do its job under vastly different working conditions. Mobiloil Arctic meets these conditions because it is a *double-range* oil. It flows freely even below zero. This gives you easy starting and sure circulation. Yet it keeps its rich body and gives full lubrication at hot running temperatures.

If you are using a heavy summer oil, at freezing temperatures, your oil becomes thick and cold-stiffened. The oil can not circulate promptly. Then a few moments of "dry" running brings deadly wear to your engine.

If you use an ordinary "winter oil" you may get easy starting. But many such oils are merely thinned oils. When your engine heats up, they fail to give protective lubrication.

Mobiloil Arctic stands alone among winter oils because it does not compromise with winter cold or with engine heat. It is the *double-range* winter oil.

Play safe this winter. Have your Mobiloil dealer drain your crankcase and refill with Mobiloil Arctic today! Then ask him for Mobiloil "CW" for your gears. On coldest days Mobiloil "CW" remains soft and cushions each gear tooth from wear. You will be delighted at the new ease with which your gears engage.

Ask here for Mobiloil

VACUUM OIL CO.

We invite you to listen to the Mobiloil Concert, broadcast each Wednesday evening at 8:30, E. S. T., from WEAF and 29 associated stations.

Mobiloil

ARCTIC *for your engine*

"CW" *for your gears*

Popular Mechanics Magazine

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Vol. 54 — Contents for December, 1930 — No. 6

Special Features

From Paddle Wheel to Electric Drive 898
High-Flying Mechanics 906
When Seeing Is Deceiving 915
Man's Mightiest Monument 920
They Get Their Man 929
Man-Made Star Guides Flyers 941
Flying Photographers Aid Engineers 947
What Is a Cloudburst? 953
In Davy Jones' Locker 962
Prophets and Their Prophecies 970
Raising the "Hindenburg" 995

Acoustics—clothes absorb sound 928
Agricultural Implements—farm-waste chopper helps improve the soil 928
Airplanes
- air-filled bags save planes in water landings 977
- are found at night by glow of exhaust 914
- engine fitted with wings seeks speed mark 926
- plane in flight takes fuel from speeding auto 960
- plane propelled by rockets 940
- rout wild horses 987
- variable-wing monoplane 945

Airship—six million rivets in 918
Archaeology—solution of Mayan mystery 904
Atmosphere—how high up does the atmosphere extend 983
Atoms—huge towers draw lightning to smash 974
Automobiles
- one of world's first autos 940
- rubber dough ends squeaks in bodies 993
- wax and polish prevent auto sunburn 914

Automobiles, Accessories
- all doors lock at once by pressing button 951
- bumper saves lives of pedestrians 992
- celluloid curtain shields eyes 918
- coat hanger keeps clothes tidy 951
- extension for brake lever facilitates operation 966
- footrest and folding table for 998
- supercharger for small car increases acceleration 960

Automoiles, Cleaning—fountain-brush washer attached to garden hose 919
Automobiles, Design—aircraft lines add to speed and power 949
Automobiles, Lighting—service station on wheels 982
Automobiles, Tires—spare tire on swinging arm 985

Aviation
- one-way traffic for planes over London 981
- robot air pilot keeps plane on true course 950
- wind tunnel makes its own flying weather 978

Baldness—caused by arsenic and lead is curable 939
Basketball—coin-in-slot 987
Bench Grinder—drill sharpener is attached to 999
Boats and Boating
- auto converted into yacht 938
- folding boat easily carried on auto trailer 987

Bottles—rubber stopper for withstands pressure 913
Bridges
- arches floated into position 913
- skyscraper, to span San Francisco bay 902

Buildings—apartments built in circles 917
Bullets, Hydrogen—at a speed of 37,000 miles a second 925
Camel—shipped by airplane across Mediterranean 977
Chandelier—neon tubes give almost white light 946
Checks—alteration of, shown by ultraviolet light 942
Church—like giant pipe organ 928
City—most ancient American 955
Clocks
- huge, built of flowers keeps accurate time 914
- lion roars and cock crows from cathedral tower 986

Coal—microbes found in 940
Cotton—field duster covers sixty rows at a time 959
Desert—sandstorm detector 925
Disease—pneumonia aid is found in cranberry bogs 982
Divers—go down deeper with aid of chamber 904
Diving
- banner carried by high diver fails to save his life 960
- robot diver to help salvage sunken treasure ships 944

Electric Heater—with a fan gives warm or cool air 986

[Continued on Page 4]

[Contents—Continued]

Exerciser—body swings in the frame of queer 994
Fireboat—tiny, used to fight inaccessible blazes 925
Football—automatic timer aids kicker 939
Fruit Jar—screw-cap opener removes lid easily 981
Glass
is considered a liquid 918
tinted, aids in make-up and saves face 951
Gliders—on ball-bearing post trains student flyers 993
Golf
automobile-tire hazard on miniature course 989
nine-hole table course 982
pool is combined with, on miniature course 999
set for parlor putting combined with ash tray 993
stroke gauge helps player improve game 998
Gun Sight—for birds in flight 938
Guns, Ordnance—mortar railway gun to aid in defending coast 951
Health—oxygen breathing room aids pneumonia victims 952
Heating and Ventilating
flame balanced on air jet in firebox of boiler 955
heat generated by motors used to warm buildings 952
Horseshoes—fifteen tons of, collected by blacksmith .. 939
Household Devices 990
Insects—colored lights used in war against 982
Invention—world's greatest hoax recalled by models .. 986
Letter—is dictated to coin-in-slot machine 944
Lightning—picture of flash taken from airplane 992
Lightning, Artificial—tests on high-tension line insulators 984
Loud Speaker
on upper deck of city motor coach 997
produces chimes without bells 919
Mailbags—give theft alarm if stolen in transit 987
Metals—electric eye sorts by light reflections 988
Mittens—for hunters leave gun fingers free 977
Music—made by electricity 994
Navy, Australian—gun turret used as "spare" 919
Nuts—leak-proof, aids storage of fluids 989
Oil Fields—failing, revived by action of water 981
Paper—from seaweeds 999
Photo-Electric Cell—magic "eye" for opera aids lighting effects 943
Piano—"silent," is audible only to the player 928
Pipe Lines—protected with expansion joint 985
Plants—spraying under the leaves 997
Poison Ivy—relieved by new drug 940
Power Line—leaks detected by airplane patrol 988
Power Plant—floating 959
Radio
clock control tunes stations in advance 918
hints and kinks from the radio lab 1004
Radio, Aerial—light-socket antenna kink 1010
Radio, Application
how heavens may be explored by radio beams 988
radio waves start milking machine in test 978
you can build this light-sensitive relay 1000
Radio, Batteries—how to alter a.c. eliminators for d.c. operation 1006
Radio, Loud Speaker—sponge remedies "squawk" in .. 1003
Radio, Receivers—short-wave receiver in unit form 1006
Radio Reception
it's easy to locate man-made static sources 1008
simple device for improving selectivity 1007
Radio, Tubes—protecting tubes that are lighted by 32-volt supply 1007
Railroads—razing rail depot tests skill of engineers .. 958
Ruler—rolling, saves eyes and time 978
Safety Devices and Measures
down safety lane 979
warning sign also gives road directions 944
Ships and Shipping—huge fog siren on lightship operated by air 946
Smoke—photographic smoke finder 994
Smokers' Accessories—valve in stem of pipe ends "bite" 943
Spray Gun—for metal tinning 989
Steel Tower—one mile high is found practical 913
Tennis—mechanical "partner" permits practice alone .. 981
Time—where the earth's surface begins—and ends 928
Tornado—man looks inside of, and tells what he saw. 917
Traffic—elevated highway for autos 955
Transportation—a pageant of transportation shows over twenty centuries of travel 956
Ultraviolet Rays—given off by ordinary gas stove 966
Vase—rubber, for flowers 918
Vibrator—portable electric 952
Watch—that shows the date 959
Weather
electric light in balloon tells wind direction 939
long-distance weather seen in polar trips 946
Whistles—train and steamer 938
Wood—flame and waterproofing agent for 998

AMATEUR MECHANICS

Animals, Miniature—made from pipe cleaners 1015
Automobiles, Accessories
alcohol dripped on windshield prevents ice 1030
clothes rack attached to auto top 1028
hookless fastener used on radiator cover 1032
Automobiles, Fuel—blowing into the tank starts this siphon 1035
Automobiles, Repairing—elastic supports for door pockets 1025
Bed—frame keeps covers off injured foot 1035
Birds—squirrel-proof feed box 1026
Boats and Boating—"Roamer" a speedy outboard cruiser 1018
Camera, Stereoscopic—cheap box cameras take stereoscopic views 1014
Cartesian Diver—diver submerges only at master's will 1029
Clock—large dial fitted to small clock 1036
Clothespin Bag—hangs on line 1034
Countersink—improvised 1035
Drain Trap—flatiron used to thaw out frozen 1028
Filter—efficient, easy to make 1025
Fire Fighting—cheap substitute for hand fire grenade. 1032
Fish and Fishing—fish saved by wet hands 1013
Furnace, Brazing—adjustable 1036
Games—"tumbler golf" for your parlor 1030
Garage—keeping motor warm in cold garage 1027
Hammer—made of pipe holds supply of tacks 1037
Hydrant—lantern in barrel prevents freezing 1037
Kitchen Table—"roll-away" cover for 1013
Letters—using paper clips in 1029
Lights—store light controlled from outside 1029
Magic—topsy-turvy match is clever bit of magic 1033
Matches—brick makes handy holder 1038
Monograms—preventing corrosion in deep engravings 1027
Musical Instruments—breaking in stringed instruments 1038
Nutcrackers—grotesque figures crack nuts 1017
Pastry—guards for pie display on counter 1015
Pen Light—finger grip holds 1031
Photography
photographing close-ups with Graflex camera 1017
single switch controls both lights in darkroom 1027
trick photograph made with mirror 1038
Potato Bin—an improvised 1034
Safety Devices and Measures—carrying a danger signal on highways 1026
Ship Models—making small boats for 1016
Stamps, Postage—handy method of removing 1028
Table, Bridge—lamps for 1032
Telephone
made from oilcans 1016
padlocking the 1031
Toboggan—made of corrugated sheet steel 1031
Tools—tool clamps wire on hose 1013
Toys—amusing, easy to make 1011
Wheelbarrow—runner for 1037
Workbench—paper roll supplies continuous covering . 1036

SHOP NOTES

Automobiles, Accessories—oil cooler for model-A Ford . 1050
Automobiles, Repairing
Ford valve guide removes carbon from valve stems 1047
heat treatment removes deep auto dents 1049
removing spindle-bolt bushings 1053
rubber disk catches valve-reamer cuttings 1048
Book Ends—making a pair of hand-wrought 1044
Building Paper—holder for 1053
Concrete—rubber shield protects worker from flying chips 1054
Dowel—jig for boring holes true 1048
Drawing Table—a cheap and practical 1051
Drill Press—extension chuck 1053
Electrolytic Rectifier—increasing capacity of 1055
Grain Spout—clothespin holds sack on 1055
Ice Pick—hose holder offsets danger of carrying 1042
Inlay Banding—making band-inlay strips 1039
Loading Platform—balanced skid for 1054
Logs—hauling attachment for the farm wagon 1050
Oil Drum—mounting for garage 1042
Photography
photographic reflector easy to make 1043
stretching photos cut too short 1048
Pipes, Water—simple device for thawing electrically 1056
Power Hammer—converting a tripod drill into 1043
Sander—old auto parts make good disk 1052
Saws and Sawing—extra handle increases comfort in using a saw set 1043
Sheet Metal Machines—revolving table for 1055
Steam Engine—rebabbitting bearings 1054
Steel—cutting self-hardening 1048
Trestle—carpenter's, aids in ripsawing 1055

Deaf-Dumb-Blind

Yet "He" STOPS Auto Thieves

What in the world IS this uncanny new discovery that so instantly terrifies auto thieves? Thieves fear it worse than poison. Its terrible power literally "petrifies" them. They cannot even remove a thing. Now your car can be absolutely safe, anywhere you leave it. Don't confuse this queer new invention with anything you ever saw. It is not a bell. Not a lock. Not an explosion. Not an electrical shocker. Not a poison gas. Yet the deadly fear it puts into thieves throws them into a panic. It works automatically the instant anyone even touches your car. Cannot injure innocent persons. Recommended by police and insurance companies. No bigger than your hand. Costs only one penny a year to operate. Almost never wears out. The cheapest, surest theft insurance you can buy. And that's not all. Excites and amuses everybody. Have lots of fun with your friends.

Mysterious New Invention Offers Agents Up To $40 a Day

So startling, so absolutely new, so peculiar is this strange discovery that agents who have already taken it on are smashing daily profit records. The greatest crowd gatherer you ever saw. The minute you demonstrate this clever invention people are bewildered. They want to know how it "stiffens," "hypnotizes," "shell shocks" thieves. The need for this scientific protection is so great—the big profit possibilities are so almost unlimited and easy—that now we will actually pay you just to demonstrate this amazing thief chaser. You don't need to sell a single one to make this money. Just stand on the street by your car and make it perform its magic wonders that set your audience agog and bring quick profits. No use wasting your time any longer with "piker" propositions. $40, $50, $75 a day is not too much to expect, is it? If we did not feel sure that you could make as much money as other men with this uncanny new discovery we certainly would not be willing to offer you pay just for demonstrating it. The protection it gives—its utter queerness—its strange power to put fear into thieves—and the fun it gives motorists make it the easiest, fastest selling, biggest money-making opportunity for you in many years.

We Pay You Just To Show It To Motorists

The market is so tremendous—orders are pouring in so fast—that we can afford to do almost unheard of things for our local distributors. Not only will we pay you just for testing it, but we will actually send you a Free Sample offer for your own car so that your car and accessories will be protected and to start you demonstrating it. Yet that's not all. We actually offer to pay you cash for merely testing it on your car. Now we have territories for 1,600 more county distributors and 100 district managers on this generous pay plan. With our nation-wide advertising plans ready to start at once, distributors should be literally flooded with orders. We have worked out a new plan so that you don't have to do any selling or demonstrating to car owners to make big money.

Mail Coupon for

FREE SAMPLE OFFER

Rush the coupon for your Free Sample offer—offer to pay for demonstrating and plan that gets you big money without doing any selling or demonstrating to car owners. Send no money. Just coupon. This is not an order. Nothing will be sent C. O. D. This Sample Offer is yours free of all cost. Just mail coupon now.

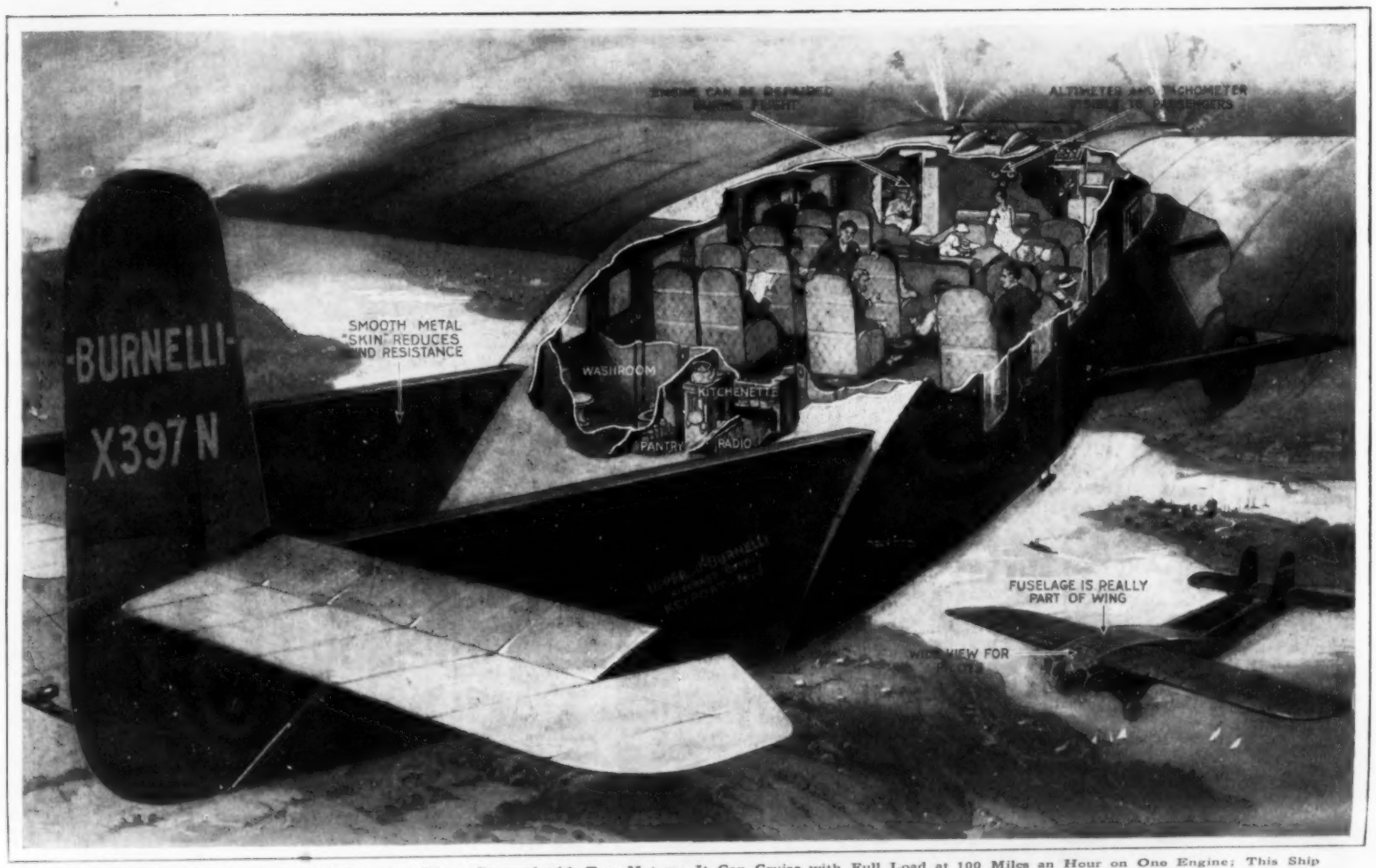
Allied Industries, Inc.,
5299 Garver Bldg., Des Moines, Iowa.

I accept your generous Free Sample offer of your amazing new thief "hypnotizer" with understanding that this offer costs me nothing now or ever. Nothing will be sent C. O. D. and I am not obliged in any way to buy anything or to become your distributor. You also offer to actually pay me for just testing it on my own car. Please send details of your offer of Pay for Demonstrating it, and also your plan that offers me big money even without demonstrating or selling to car owners. If I become your local distributor you agree to give me exclusive territory.

Name.....

Address.....

City.....*State*.....



Artist's Drawing of Uppercu-Burnelli Transport Plane, Powered with Two Motors; It Can Cruise with Full Load at 100 Miles an Hour on One Engine; This Ship Is a Close Approach to the So-Called "Flying Wing"

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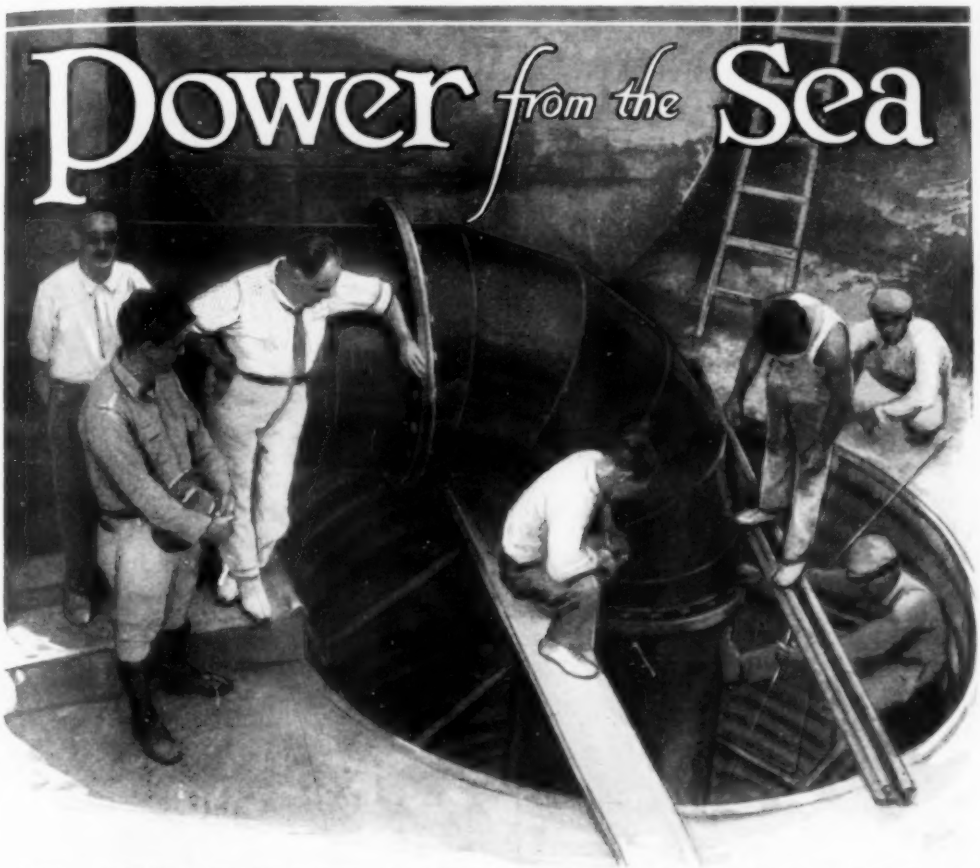
Power from the Sea



Members of Professor Claude's Staff Examining Well into Which Great Sea Tube Leads; the Joint Shown Here Connects the Tube with the Pumps Which Force Water through the Steam-Generating System

GEORGES CLAUDE dips his hand into the Gulf Stream. The water is warm. At sea level water boils at 212 degrees. But on a mountain the boiling point may be 180 degrees. The result in both cases is steam—power—motion.

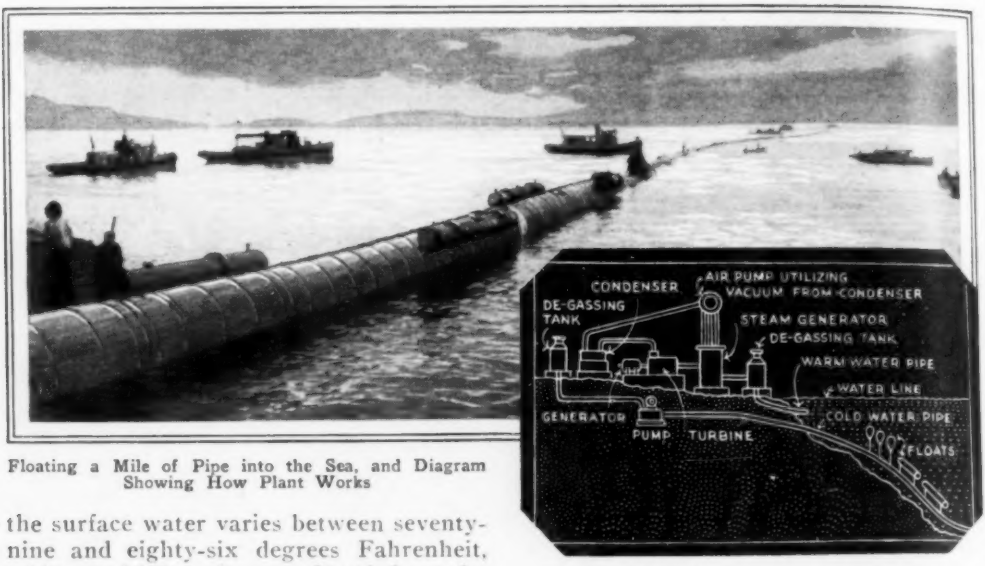
From these simple steps, Professor Claude, after five years of effort, has succeeded in harnessing the energy in tropical water, and producing enough of it to light forty 500-watt bulbs and keep them burning.

From his laboratory on the sea's edge at Matanzas, Cuba, on October 1, he reported that his turbine had generated more than twenty horsepower. The following day his enthusiasm found expression in a cablegram to Popular Mechanics Magazine, saying:

"Yesterday we ran for the first time a plant seeking at the sea bottom a particle of its boundless thermic energy. Our expectations are justified. The modest twenty kilowatts generated until now, under adverse conditions, are a prelude to powerful installations already projected, and an assurance that human industry will not perish some day for lack of mechanical energy to animate it."

It is common knowledge that temperature varies greatly as one descends in the sea. At Matanzas bay, Claude found that

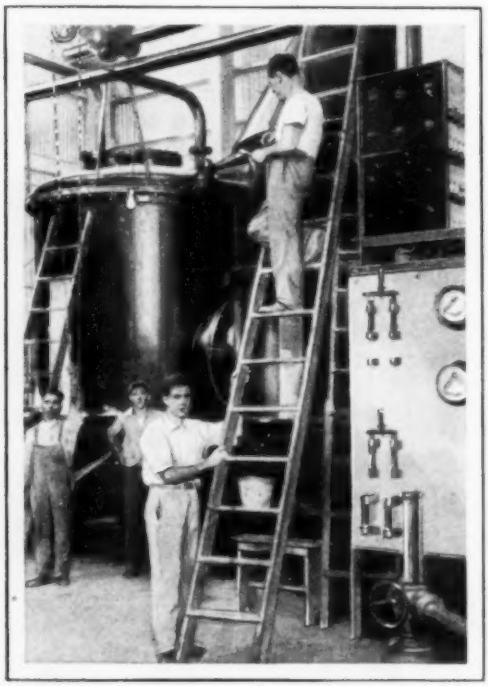
Artist's Drawing of Upperco-Burnelli Transport Plane, Powered with Two Motors; It Can Cruise with Full Load at 100 Miles an Hour on One Engine; This Ship Is a Close Approach to the So-Called "Flying Wing."



Floating a Mile of Pipe into the Sea, and Diagram Showing How Plant Works

the surface water varies between seventy-nine and eighty-six degrees Fahrenheit, while at 2,000 and more feet below, the temperature is constant at forty degrees.

In a steam engine, burning fuel converts water into hot vapor. But Claude utilizes another principle, namely, that warm water vaporizes in a vacuum. If air pressure is reduced sufficiently, water will boil even at room temperature.



Hot-Water Purifier and Boiler in Which Steam Is Generated; Switchboard Controls Motors and Pumps

Having found a way to generate steam, he can run a turbine, but in order to keep a constant vacuum, he must find a way to condense the steam and reduce its volume. Everybody knows what happens when one holds a cold glass over a steaming tea kettle. Drops of water condense on the surface. That was Claude's cue. If he mixed steam with cold water, condensation would follow. And that is why he introduces cold water into his process.

This is the way it works: Surface water and water from a depth of 2,000 feet are brought to the shore plant. A pump forces surface water into a low-pressure boiler where it boils at seventy-eight degrees. The steam generated turns a turbine. The exhaust goes to a chamber where the water from 2,000 feet condenses it and perpetuates a vacuum. The vacuum allows water to boil at seventy-eight degrees, and so the process is continuous.

The Matanzas plant, Claude says, is merely a beginning to what might be done with the energy now going to waste. He speaks of a continental refrigerating system to make power plants on the North African shore to cool the Sahara desert, irrigate its vast reaches and make it habitable. He would also industrialize France's tropical empire with a chain of sea-power stations. He predicts that tropical peoples will adjust temperature to their own likings. Public utilities may sell ice at one-twentieth the present cost.

These dreams exercise Claude's mind.

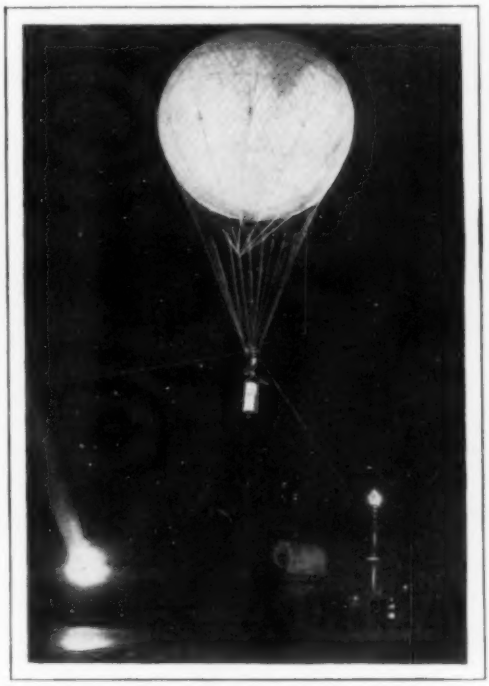
Each dream is the birth of an invention. Are they fantastic? Not more so than Claude's neon lights fifteen years ago. Four hundred million dollars have already been invested in his ideas. He invented a method of manufacturing liquid air. He captured two rare gases from the atmosphere, krypton and xenon; the latter has sold for $13,650 a quart. The Muscle Shoals dam is built around his nitrogen-fixation process. He took acetylene gas out of the laboratory and made it a commodity. He devised a process for manufacturing synthetic ammonia. The transatlantic telephone and telephoto process make use of his neon tubes. During the war, he mixed liquid oxygen and lampblack and produced a most deadly explosive. He taught the allies how to load liquid chlorine into shells. In aeronautics, he invented an instrument for locating enemy batteries through sound waves.

MATCHLESS LIGHTER FOR GAS IS AID TO DENTISTS

Automatic lighters to ignite the gas jet in the dentist's office now is being offered to replace the old-style alcohol lamp. It consists of a small metal tube with a finger grip attached. Inside the tube is a spring bearing against a flint. This in turn presses on a striker wheel which, when revolved,

Automatic Lighter Containing Flint and Striker Wheel to Ignite Gas Jet in Dentist's Office

throws a series of sparks into the escaping gas, igniting it.



Los Angeles Traffic Officer Directing Auto Travel from Captive Balloon above a Boulevard

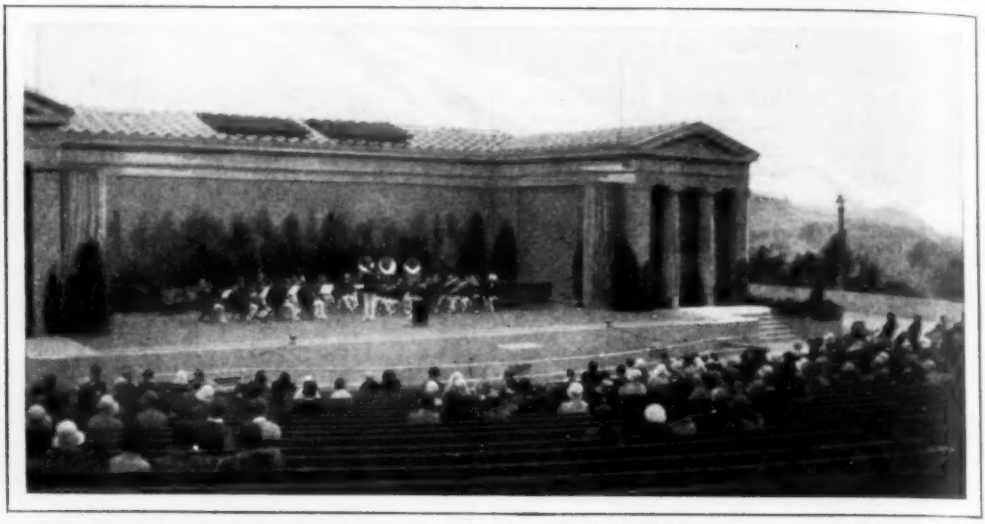
COP DANGLING FROM BALLOON DIRECTS AUTO TRAFFIC

Los Angeles motorists were startled recently when an aerial-traffic officer, dangling from a captive balloon fifty feet above the street, began directing traffic on one of the busiest boulevards. The lofty perch for the officer was tried as an experiment in order to afford better visibility and thus allow him to keep traffic moving at a faster clip by anticipating the requirements of the approaching lines of cars.

EXTRA-THIN RUBBER GLOVES HELP SURGEON OPERATE

Surgeons' rubber gloves, so thin that they do not lessen the sensitiveness of the fingers, and yet so strong that they withstand the severe usage to which they are put, are being manufactured by a recently developed process. The material is prepared, by a method somewhat akin to the process of electroplating of metals, directly from the rubber latex. The thin rubber is said to have unusual age-resisting properties and to be unaffected even by repeated sterilizations.

LIVE TREES ON THEATER STAGE SERVE AS SCENERY



Living Trees Used as Stage Decorations in the Greek Theater at Los Angeles; Palms and Other Varieties Are Planted in Boxes so They May Be Shifted About for Scenic Effects

Living trees replace the usual painted ones on the stage of the recently opened Greek theater in Los Angeles. Palms, pepper trees and other varieties are planted in boxes so that they may be moved about for different scenic effects.

MAGNET TEST ON WELDINGS REVEALS DEFECTS

Parts that have been electrically welded can now be tested without knocking them apart or destroying costly pieces of metal by means of a magnetic apparatus introduced by the Westinghouse research laboratories. The outfit is portable and requires comparatively little skill to operate. On butt welds, for instance, the seam is bridged by a large horseshoe magnet, and the magnetic field explored with a meter. By passing the meter over the weld and watching a pointer, the quality of the weld may readily be determined. The gauge compares the magnetizing forces across the weld with those of the steel plate. If the two are about the same, the weld is good, if not, the weld is inferior, and the meter will tell just how bad it is. The method has advantages over previous testing processes in that it operates regardless of the depth of the fault.

Magnetic Apparatus and Gauge Being Used to Test Efficiency of an Electric Welding Job

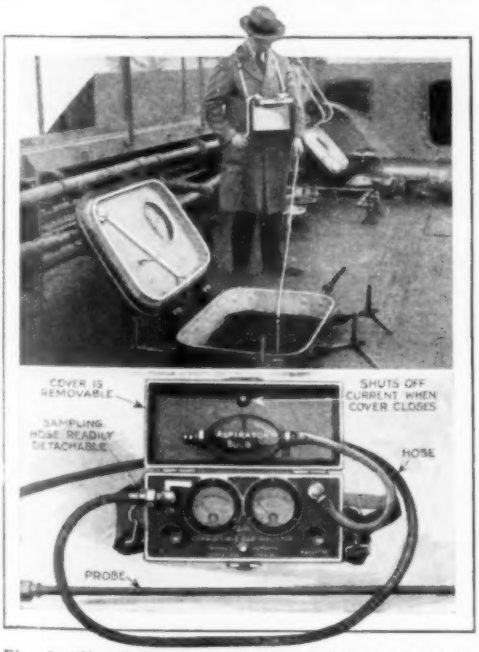
AIR VALVE FOR LOUD SPEAKER IMPROVES TONE QUALITY

Compressed air is being used in one large loud-speaker unit employed principally for auditoriums and outdoor broadcasting to increase volume and improve tone quality. An air valve, connected to a small compressor, is placed close to the vibrating reed of the speaker unit, and from it extends the horn that finally emits the sound. As the amplified signal from the radio set or phonograph causes the reed to vibrate, the sensitive air valve is opened and closed in accordance with the frequency of the sound produced. Each time the valve is opened, a minute jet

of air escapes, the sequence of these jets forming, for instance, a musical note of considerable volume.

ELECTRIC NOSE DETECTS GAS AND GIVES WARNING

Smelling by electricity is accomplished, in effect, by an apparatus which explores gas-filled chambers and indicates its findings in terms of nearness to explosibility. The electric "nose" bears no resemblance to any ordinary proboscis, but consists of a long exploring tube to be inserted in the suspected place. This tube sucks vapors, by means of an aspirator bulb, into a case containing an air-tight chamber with heated platinum wires. The changing resistance of the wires as various gases pass over them causes a tiny indicating needle to register on a dial. The nose can be poked into the holds of vessels, and into tanks, sewers and conduits suspected of containing dangerous gases. The instrument is also useful in testing for leaks in pipelines carrying crude oil or natural gas.



Electric "Nose" Which Sucks Vapors into an Artificial "Lung" That Indicates Explosibility

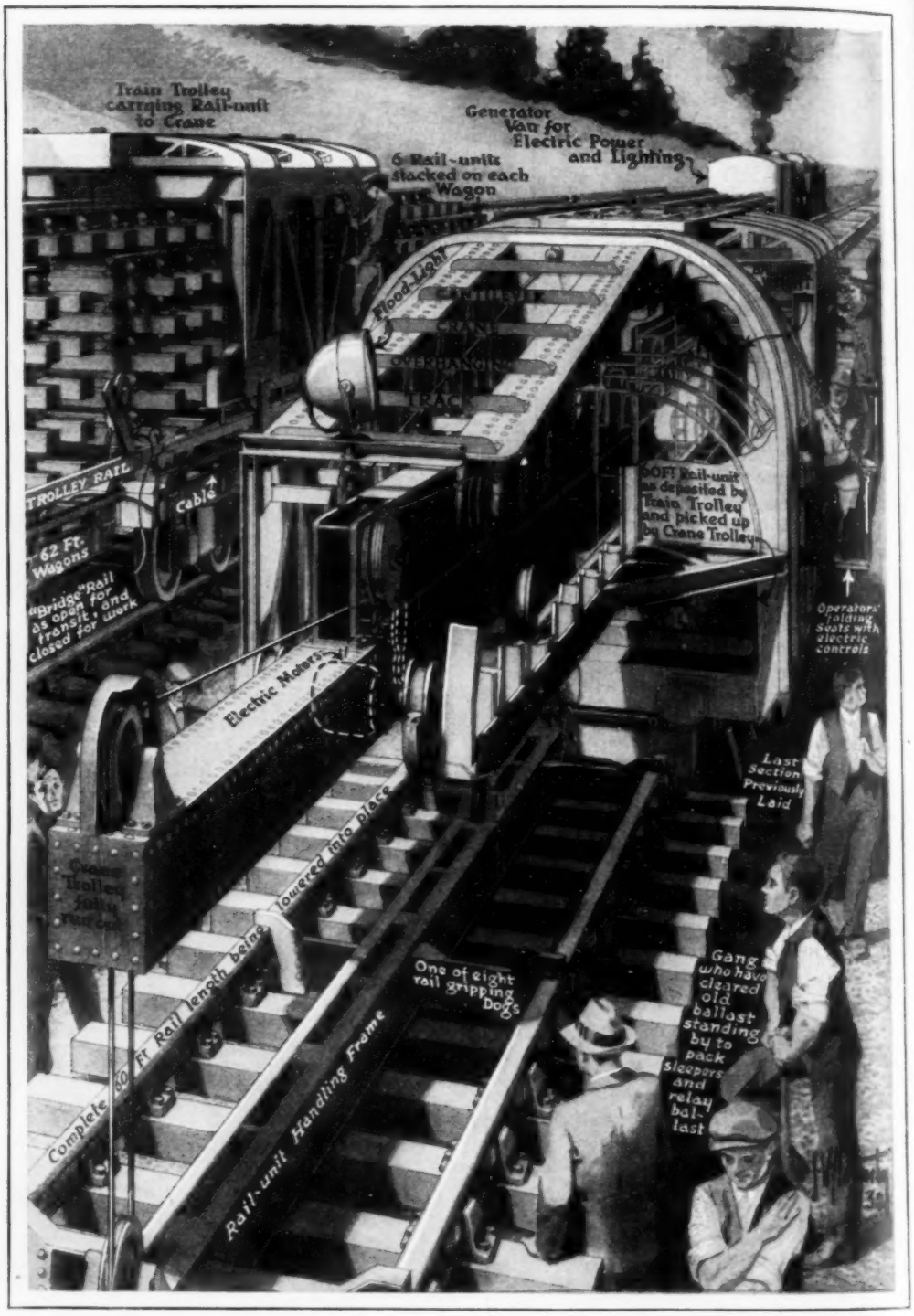
Corrugated-Iron Base for Brick Highway; Sheets of Iron Have Been Found Both Durable and Economical

BRICK ROAD ON A METAL BASE MAKES LASTING HIGHWAY

Traffic of the future may move over iron highways if continued tests with metal road bases are as successful as early experiments near Springfield, Ill. Here an iron base for a brick road has been found to be economical and virtually indestructible. First the road is carefully rolled, then sheets of rust-resisting corrugated iron are spread and on top of the base a sand cushion. After the bricks are laid, an asphalt filler is poured between the interstices. The base, aside from its durability, offers sufficient flexibility to meet all changes in temperature without breaks or cracks. When the sheets are laid parallel, the edges are turned down to grip the road, and at the curb turned up.

SHORT NAMES FOR TOWNS

At least two towns in the United States are easy to remember, and postal clerks, especially, appreciate their two-letter simplicity. They are Ai in Georgia and Uz in Kentucky. West Virginia seems to lead in the number of towns with short names, many with but three letters being found. Among these are Van, Gip, Ona, Hur, Oka, Ira, Pax, Sun, Due, Hoy, Rio, Fry, Tad, Mud, Sod, Man and Dan. Postoffice names include such queer ones as Ink, Igo, Gas, Fob, Cid, Duo, Aid, Aud and Ojo.



© Popular Mechanics Magazine

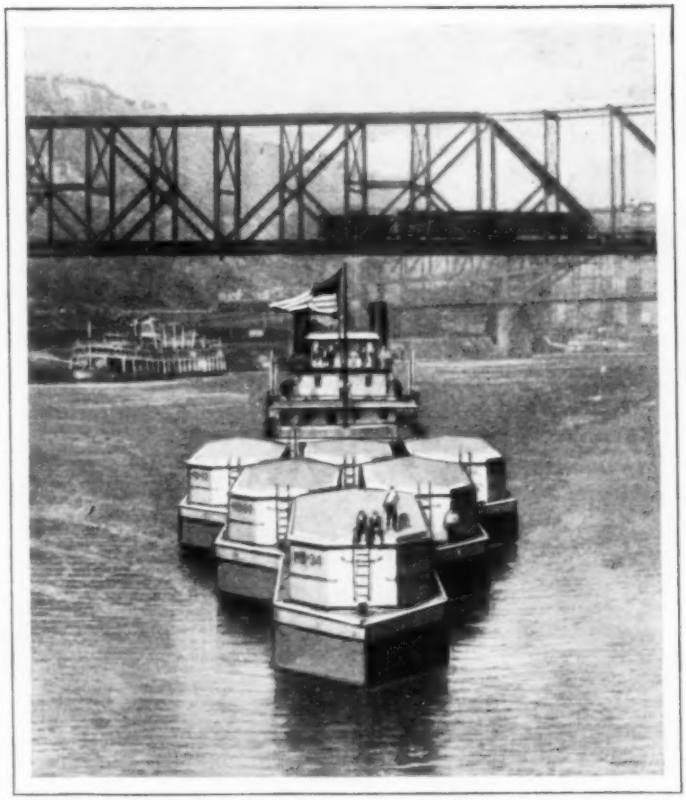
How Railroad Tracks Are Laid in England; the Machine Handles Whole Sections at One Time at the Rate of Not Less Than 200 Yards an Hour; an Electric Crane Is the Chief Power Unit

STUDY OF DISEASE AIDED BY MOVIES OF HEARTBEATS

By means of apparatus developed at the University of Pennsylvania, photographs of human heartbeats are now being made so that more accurate studies of the organ may be conducted in the treatment and diagnosis of various disorders. This has been possible because contraction and expansion of the heart muscles are attended by definite electrical disturbances in the body. These actions precede each beat of the heart by a small fraction of a second and can be measured and recorded. At the same time, by means of X-ray apparatus, the outer edge of the heart is photographed on moving film. The register of the beats and the X-ray film are then superimposed and photographed together, giving a graph of the actual movements of the organ. The galvanometer, which registers the electrical disturbances caused by the beating of the heart, is not affected by the X-ray outfit using high voltage.

WINDOWS IN EARS OF RABBITS SHOW GROWTH OF CELLS

Through glass "windows" introduced in the ears of rabbits, scientists now are able for the first time to study over an extended period the microscopic details of the growth of living tissue in a warm-blooded animal. It is hoped that the method, developed at the University of Pennsylvania school of medicine, will yield information regarding the manner in which abnormal cellular reactions occur in infectious diseases, including tuberculosis, tumors and cancerous growths. A transparent, double-walled chamber, or window, is introduced into a small hole in the ear of the rabbit.



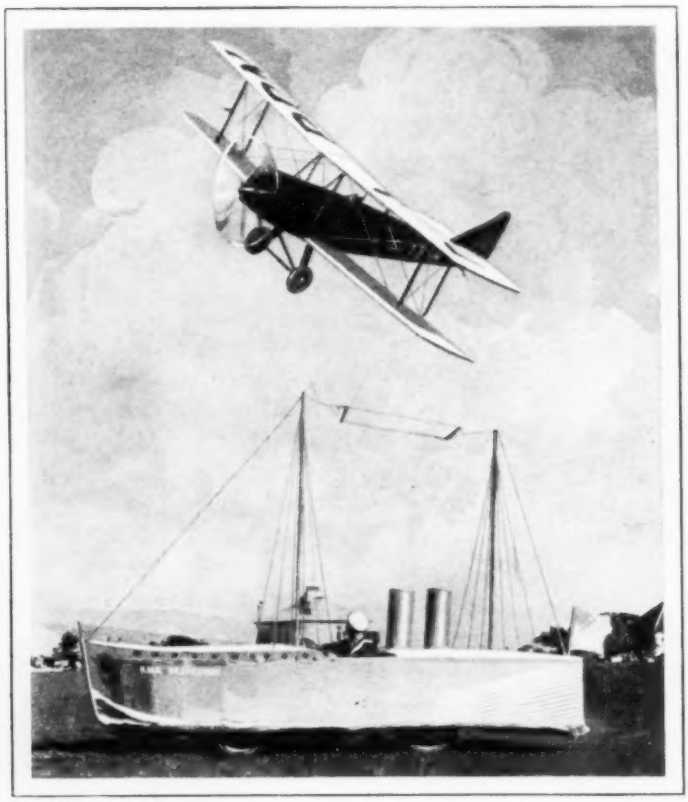
River Barges with Pointed Bows and Sterns Which Make It Possible to Tow Them in Clusters in Wedge-Shaped Formation

BARGES WITH POINTED BOWS OPERATE IN CLUSTERS

Barges with pointed bows and sterns are being operated on the Ohio and Mississippi rivers, these boats replacing the ordinary barge with its "duckbill" bow. The sharply pointed ends make it possible to tow the barges in clusters by arranging them in a wedge-shaped formation which decreases water resistance and allows them to move in a compact unit.

LAMP SHINES INSIDE THE BODY TO TREAT DISEASE

Ultraviolet-ray treatments for the interior of the body as well as the exterior are now possible with the aid of a lamp which a German physician has introduced. With it is combined an optical system whereby the attendant can observe the effects of the instrument upon the internal organs.



Bombing Plane Swooping Down in an Attack on a Land-Going "Dreadnaught" Mounted on a Truck during a Recent British Air Show

WARSHIP MOUNTED ON TRUCK TARGET FOR PLANES

As a target for bombing planes during a recent British air pageant, a "dreadnaught" was mounted on a truck and driven across a field while the air raiders attempted to score hits by dropping "duds" from overhead. The land-going warship was not as large as a regulation battleship, and its maneuverability on the field also made it a difficult target.

ELECTRIC NUTCRACKER SAVES OIL-BEARING KERNELS

Palm nuts, which grow in profusion in tropical countries, and are extremely rich in oil, have been made available for a wide variety of uses by the invention of an electric nutcracker, weighing two tons, which is necessary to remove the almost impenetrable shells. In the jungles, the natives have long used the nuts, after hours of laborious work in cracking them, for food and drink, for the oil which furnished them with artificial light, and for brilliant-hued paints as well as for medicinal purposes. After several years of experiment, a motor-driven machine was built which will crack the nuts without crushing the kernels, and will separate the kernels from the husks and shells. The nuts are dumped into a large hopper of the six-foot machine and are fed through tubes to heavy plungers exerting a pressure up to 16,000 pounds a square inch. The cracked nuts pass to a sievelike table which agitates them to separate the kernels. Similar machines, operated by hand, water or horse power, also are built. The cohune nut, a variety of the palm nut, contains sixty to seventy per cent by weight of high-grade vegetable oil which is used in the manufacture of soap, candies, butter substitutes, paints, salad oils, and for general cooking purposes. The residue is used for cattle food, and the nutcracker handles about 100 tons a day.

SMALL X-RAY TUBE OPERATES AT HIGH VOLTAGE

Less than two inches in diameter and only four inches long, the smallest commercial X-ray tube in use has been made in the General Electric research laboratories. Despite its diminutive size, the tiny tube operates at 56,000 volts.

A $25,000,000 Mile

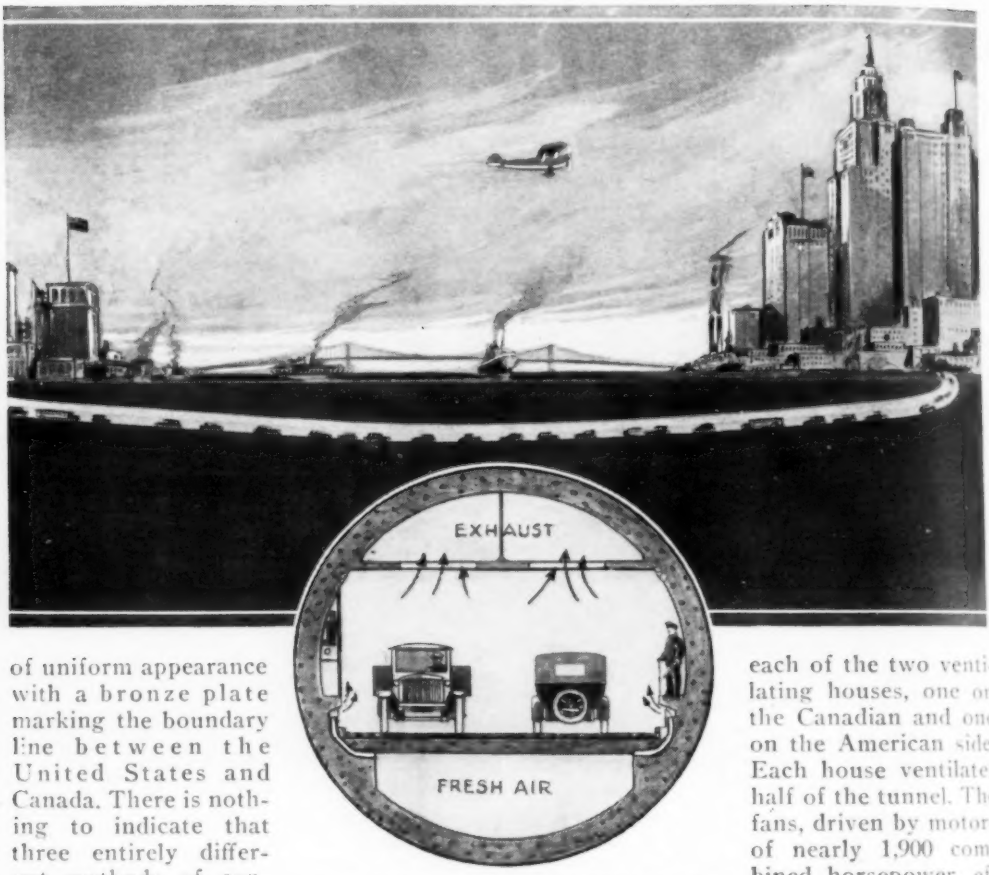
View of One of the Big Tunnel Tubes before Launching and Sinking. Showing the Water-tight Bulkhead

AUTOS now are whizzing between the United States and Canada through the first international vehicle tunnel ever constructed. A mile long, breeze-swept by gigantic fans, gleaming like a rifle barrel and as clean as a tiled kitchen, this latest engineering triumph that connects Detroit with Windsor, Ont., links the nations together.

Every foot of the $25,000,000 submarine mile reflects the romance and daring of engineering. Tons of steel and concrete tubes were floated like corks and sunk in a ditch at the bottom of the river. A 250-ton shield, the largest ever constructed in this country, was pushed through yards of clay to score a perfect bull's-eye with an invisible mark deep under the Detroit river. Massive sections of the tunnel, nearly as long as a city block and weighing thousands of tons, were submerged and linked together as accurately as boiler pipes. A hole under the river, but much of it was constructed on dry land, then launched and sunk at the busiest shipping scene in all the world. In season, three boats pass each moment, 27,000 a year, at this point on the Detroit river, more than ply the Welland, Suez and Panama canals combined, but the work, requiring nearly three years, was finished without a single interruption to regular traffic.

Like one of nature's own caverns, this man-made cave has been built for the ages. Steel in the tunnel, engineers predict, will possibly rust away within three centuries, but the concrete shell will grow harder for 1,000 years until it becomes an everlasting monolith. Reflectors for the subway's nearly 600 lamps are of a special metal that will never grow dim and never need polishing. Illumination is so effective that drivers do not need to use their headlights. The twenty-two-foot roadway, which can accommodate 1,000 cars in either direction each hour, has been constructed of one of the most durable materials known—granite—2,000,000 blocks of it set in tar on concrete and designed to last for centuries.

Autoists, driving through the tunnel, see a beautifully lighted, curving passage



Artist's Sketch of Tube before Completion, and Sectional View to Illustrate Air Circulation

of uniform appearance with a bronze plate marking the boundary line between the United States and Canada. There is nothing to indicate that three entirely different methods of construction have been followed and that parts of the subway were once floated down the river like big boats. The side walls, gleaming in the radiance of big lamps numerous enough to illuminate a city of hundreds of homes, tell a story also. They are lined with a special glazed metal, set in tilelike units, a material devised especially for this job. In part of the passage, there is another interesting feature. For the first time in a tunnel of large size, steel has been employed instead of iron or wood for the lining. This was done to effect a great saving in weight and expense.

As he speeds under the river, the motorist breathes air which is purer than that in the average city street during rush hours. It comes in through ducts at the bottom of the passage and is withdrawn through outlets at the top, the circulation being set up by the big fans, twelve in each of the two ventilating houses, one on the Canadian and one on the American side. Each house ventilates half of the tunnel. The fans, driven by motors of nearly 1,900 combined horsepower, effect over forty complete changes of the air inside the passage every sixty minutes.

Attendants are stationed along the way to summon aid in case of breakdown or accident, and to be on the watch for fires. Motorists are forgetful and are likely to enter the tunnel without sufficient gasoline to complete the trip, short as it is, so arrangements have been made to rush tanks of gasoline to stalled cars.

One of the most interesting details of the tube is the way in which the freshness of the air is tested. This is a continuous operation and, should the percentage of carbon monoxide rise to the danger point, a warning bell rings automatically. A small quantity of the air exhausted from the tunnel is drawn off and passed through chemical apparatus which records the percentage of carbon monoxide on a moving chart. In case of an excessive amount, alarm is sounded at once.

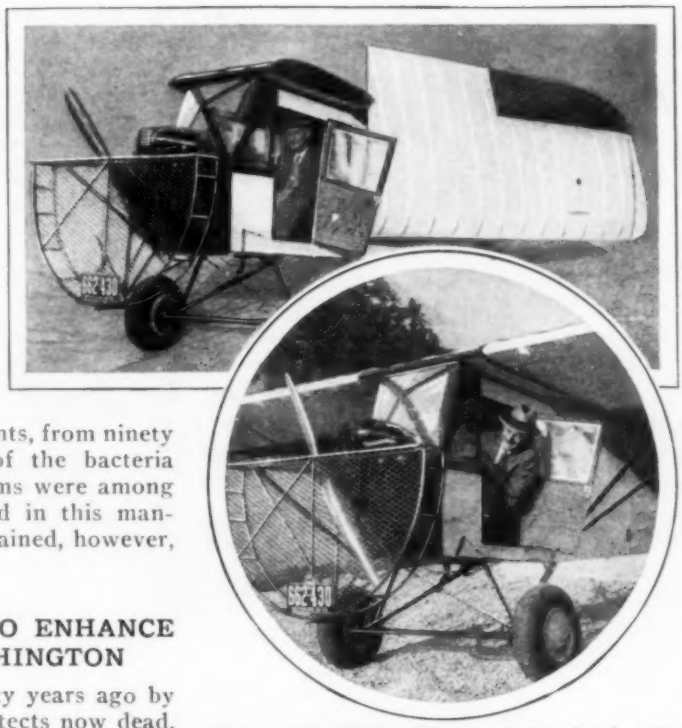
SKIN KILLS GERMS OF DISEASE

That the skin is more than a mere protection against infectious disease and a covering for the body has been demonstrated by doctors of the Illinois state department of health. Tests have shown that the skin kills various disease germs. Broth cultures containing bacteria were applied to the skin of human subjects. Within a few moments, from ninety to ninety-five per cent of the bacteria were killed. Typhoid germs were among the most readily destroyed in this manner. The results were obtained, however, only on clean skin.

SUNKEN GARDENS TO ENHANCE BEAUTY OF WASHINGTON

Planned more than thirty years ago by sculptors, artists and architects now dead, work has finally been started, after many delays, on the sunken gardens about the base of the Washington monument in the national capital. The beautiful shaft is to be further enhanced by elaborate landscaping, terracing and foliage surrounding the monument, thus providing an attractive setting when the memorial is approached from any direction.

Model of Design for Sunken Gardens Which Will Surround the Washington Monument



Airplane with Folding Wings and Guarded Propeller to Travel on Ground or in the Air

WINGS ON FLYING AUTO FOLD BACK AGAINST BODY

Designed to speed through the air at seventy-five miles an hour, or to bowl along a highway at a similar clip, a flying automobile that combines air and ground transportation has been made by a St. Louis inventor. The airplane-automobile is powered with a four-cylinder engine developing forty horsepower, and has wings so constructed that they can be folded back for ground travel. Thus it may be possible with it to take a trip by air, land at an airport, fold the wings, and drive home through crowded streets to store the machine in a garage. The propeller is incased in a protective screening for safety on the ground, and there is a steering wheel for ground travel and a control stick for air riding. The craft has three wheels attached like airplane landing gear.

Courtesy Vickers, Ltd.

Combined Rifle and Machine Gun Converted from One Type to Another by Throwing a Lever; It Fires 300 Rounds a Minute

RIFLE-MACHINE GUN INCREASES EFFICIENCY OF INFANTRY

Converting every infantryman in an army into a machine gunner, a combined rifle and machine gun has undergone successful tests recently in England. By moving a lever near the trigger, the weapon can be used either as an ordinary rifle or as an automatic gun. Employed in the latter capacity, it is mounted on a bipod and fires 300 rounds a minute. As a rifle, it can fire ninety aimed shots a minute. It can shoot 1,500 rounds without stopping and without cooling.

BIRDS CONFUSED BY CITY LIGHTS DURING NIGHT MIGRATIONS

Floodlighted buildings, beacons and other lights in city areas are costing the lives of many birds. In the spring and fall, during the annual migrations, some species of birds fly by night. Apparently confused by the lights over a large city, many fly off their course, dash themselves against the buildings and are killed. Scientists and lovers of birds have been seeking ways to prevent this without interfering with the efficiency of the lights. The use of audible warnings has been suggested, but birds are as often attracted as repelled by noises, hence these might defeat the purpose of the experiment. On some structures it would be possible to adjust nets so that the birds would be stopped before they had struck the sides. While the lights are believed to attract some birds, the chief menace is thought to lie in the fact that the brilliance blinds them to obstructions they otherwise would be able to avoid. Many varieties fly at comparatively low altitudes at night, just above the height of the tree tops, and they are thus in range of the city skyscraper and other obstacles. An experiment with the net idea is to be tried on a Chicago skyscraper where a beacon has been installed.

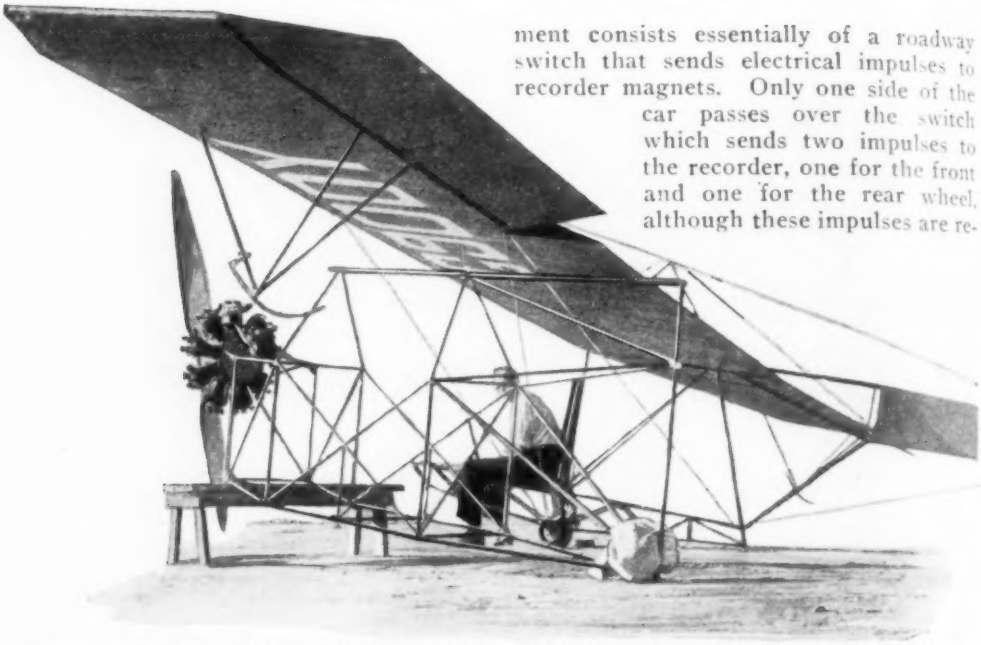
SCOOTER LIKE ROLLER SKATE HAS RUBBER TIRES

Some of the features of roller skates are included in a scooter intended for children older than those interested in the ordinary scooter. The scooter skate has three rubber wheels, two in the rear and one in front, the wheels holding a metal base which forms a support for the foot. A toe clamp makes straps unnecessary and an adjusting device fits the roller to any foot.

GHOSTLY VOICES BROUGHT FROM BOTTOM OF SEA

Patient inside Compression Chamber at Washington Navy Yard, Testing Undersea Telephone That Works without Batteries and Is Not Affected by Water; Instrument Promises Great Aid in Rescues

Above, Remarkable Photograph of Diver in Action, Using the Batteryless Telephone, and, at Right, Pose to Show How Instrument Would Be Used in Actual Operation; Man on Left Is Communicating with the Diver; the Line Is a Combination Lifeline and Telephone Cable, and Voice Is Amplified through Special System That Gives the Effect of a Loud Speaker



Interchangeable Plane Which Can Be Converted from a Glider to an Airplane by Attaching the Wings and Frame Forming the Glider to a Fuselage Which Contains the Engine

GLIDER CONVERTED INTO PLANE BY ATTACHING FUSELAGE

To enable student pilots to master the principles of flying in a short time, a Los Angeles aviation engineer has built an interchangeable plane which can be converted from a glider into an airplane and back again in a short time. When the beginner takes the controls, the ship is a glider, consisting of little more than the wings and a frame for the seat and landing gear. When he has mastered gliding, he moves the lifting surface of his craft onto a motored fuselage, and immediately has a forty-horsepower airplane with a top speed of eighty-five miles an hour. With this convertible equipment, the inventor claims, the student can learn to fly after four hours of instruction, and when the craft is used as an airplane, it can be flown for less than a dollar an hour.

PASSING AUTOS ARE COUNTED BY AUTOMATIC RECORDER

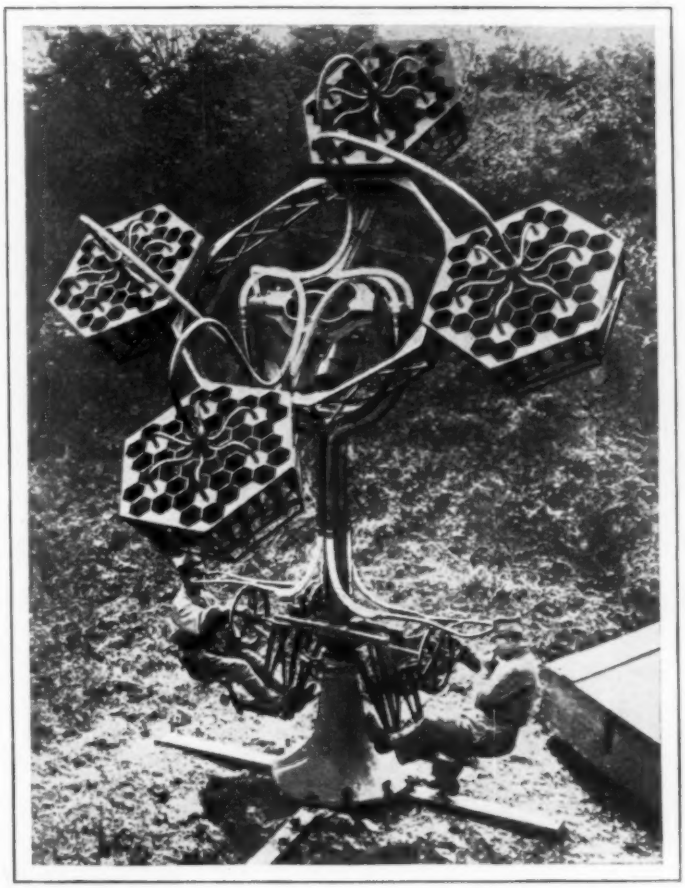
To keep an accurate record of all vehicles passing a given point, an automatic traffic recorder is being used on some toll bridges and at other points. The equipment consists essentially of a roadway switch that sends electrical impulses to recorder magnets. Only one side of the car passes over the switch which sends two impulses to the recorder, one for the front and one for the rear wheel, although these impulses are recorded as one. The record, on a tape, shows the count of the vehicles, the time of day in minutes and hours, and the day of the month. A push button, pressed when a six-wheeled truck or four-wheeled vehicle with a trailer passes, makes provision for these additional impulses by printing the letter "T" before the count. Different-colored inks or identifying letters are used where a battery of the recorders are installed, thus keeping a record for each traffic lane.

ELECTRIC MANICURING OUTFIT SAVES TIME OF USER

Time for a manicure is reduced to fifteen minutes, instead of the half hour ordinarily required, by the use of an electric outfit. It consists of a flexible shaft with an opening in the end into which various attachments fit. All operations from filing to buffing are performed by the set.

ENGRAVING PLATES OF RUBBER

Rubber is being used instead of metal for printing plates, and one authority predicts that the material will be used in at least two-thirds of all commercial work. Rubber is adaptable to any type of printing except halftones and may be used for water color or ink printing. Syndicate matter, usually furnished to newspapers on traditional metal "boiler plate," is now being distributed on rubber plates. Among the advantages claimed for rubber are elimination of exact sketching and coloring for reproduction, softer colors more even distribution of ink, less consumption o ink and a general reduc tion in cost.



Airplane Finder Which Locates Ships in Flight, and Registers Their Altitude, Speed and Distance from the Apparatus

ROBOT TO STEER MOTORBOAT ON OCEAN VOYAGE

Resembling the pontoon of a seaplane in design, a twenty-one-foot motorboat, steered by a robot pilot while the lone occupant sleeps, has been built to attempt a 2,227-mile voyage from Santa Monica bay to Honolulu. It has a forty-four-inch beam and thirty-six-inch draft. The builder estimates his craft will have a speed of forty miles an hour.

Seagoing Motorboat Resembling a Hydroplane Pontoon; a Robot Steers While the Lone Occupant Sleeps

HUGE "EAR" LOCATES PLANES AND TELLS THEIR SPEED

Resembling a huge metal sunflower, an airplane finder is being employed by the French aerial forces. It locates airplanes in flight, and automatically registers their flying speed, altitude and distance from the finder.

¶To reduce the smoke evil, the General Electric company has designed an electrical trap which consists of a series of plates installed in the chimney and subjected to high-voltage current; in a few hours, the soot settles on the plates and is removed by a water spray.

Miniature Golf and Billiards Combined in a Table Game; Golf Balls Are Shot with Billiard Cues over the Fairways

BILLIARDS AND GOLF COMBINED LATEST TABLE GAME

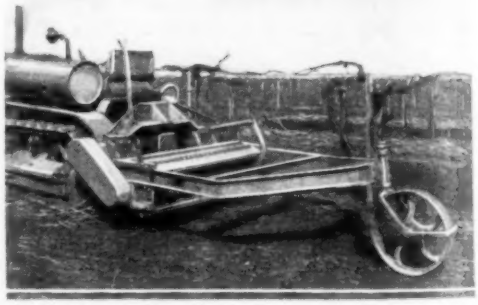
Thrills of miniature golf and billiards both are enjoyed in a table game now on the market. Regular golf balls are used and billiard cues take the place of clubs. Thus combined golf and billiard skill is necessary to send the balls through the various hazards and into the holes. If desired, the course can be set up on the floor and clubs used.

DROUTH CAUSES FISH LOSS IN NINETEEN STATES

Millions of fish were destroyed by the drouth last summer in at least nineteen states, and, although rescue activities helped preserve the stocks in some localities and there was an unusually successful hatch of bass, the bureau of fisheries predicts that there will be a shortage of fish in many streams for some time to come. Fish that were not killed by the entire drying up of streams, were stranded in small pools where they became easy prey to snakes and other animals, and, in some cases, the smaller ones were devoured by the larger fish, driven to cannibalism by the shortage of food. The depletion of the fish supply will not have an appreciable effect on the commercial situation, however, the bureau declares, for the reason that the shortage is confined mainly to the inland streams where most of the fishing is done by sportsmen or private owners.

TRACTOR-DRAWN SHREDDER FOR VINEYARDS

Clearing vineyards or orchards of brush is simplified with a shredder which is pulled by a tractor. The brush is picked up by means of a rake, and, as the tractor moves forward, it is thrown into a revolving cylinder studded with teeth and knives which cut the vines to bits thus making it easy to plow them under and giving the vineyard the advantages of a good fertilizer and mulch. Disposing of grape vines has always presented a problem, and the usual method of laboriously gathering them and then burning has been found costly. The shredder, which converts the waste into fertilizer, covers about five or six acres an hour.



Grapevine Shredder Which Cuts Up Brush, Like That Shown Above, so It Can Be Plowed Under

EUROPE IN THIRTY HOURS IS HOPE OF INVENTOR

Six-Foot Model of a Hydro-Speedboat Driven by Airplane Propellers; at Right May Be Seen the Three Stabilizing Keels with Their Triangular Fins Which Help Maintain Balance

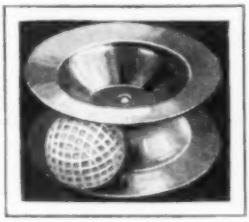
Successful tests recently were conducted with a six-foot model of a proposed 750-foot hydro-speedboat embodying principles of both air and seacraft. Three stabilizing keels run the length of the craft, triangular fins being attached to them to keep the boat on an even keel when riding the waves. The hollows formed by the keels lessen water resistance and increase speed. The boat is powered with four Diesel engines on top of the craft, which transmit power to air propellers of a type similar to those used on airplanes. The speedboat is steered like an airplane, and the inventor believes that it will be possible to cross the Atlantic in thirty hours with the full-size ship.

TREK OF CHIMNEY SWIFTS STILL IS MYSTERY

Where do chimney swifts spend the winter? This question offers a mystery of the air that probably will not be solved until the forests of the Amazon valley have been explored thoroughly. These birds start south from the United States about the first of October, journeying to the Gulf states and continuing to some point much farther south. They have been seen in Haiti and in Mexico, but this was not their ultimate destination. Little numbered identification tags have been placed on more than 30,000 swifts to solve the mystery, and, while many have been trapped inside the United States, none has ever been recovered outside the national boundaries. Some ornithologists believe they winter in the little-known Rain forest of the Amazon river in Brazil. Their disappearance led to a legend of many years ago that they hibernated beneath the waters of lakes and marshes, a belief not yet entirely erased from the popular mind, although science always has scoffed at it.

PUTTING TRAP REPLACES HOLE IN PARLOR GOLF GAME

Indoor golf now can be played in the parlor without the use of improvised holes with unnatural inclines leading to them. Instead, a putting trap, which catches and holds any ball that would be holed on a regular green, is employed. The trap, of the same diameter as a regulation hole cup, consists of two disks which are held in parallel position under slight spring tension. The trap is adjustable to retain either the old or new size balls. Several of the traps placed on the rug form a miniature course in the living room with furniture for the hazards. The traps also may be used on the lawn.



From Paddle Wheel to

Photos Courtesy

By JOHN L. DRAPER

FROM the deck of the windjammer of just a few years ago to the express liner of today is a long step, but it has been made in a comparatively short space of time.

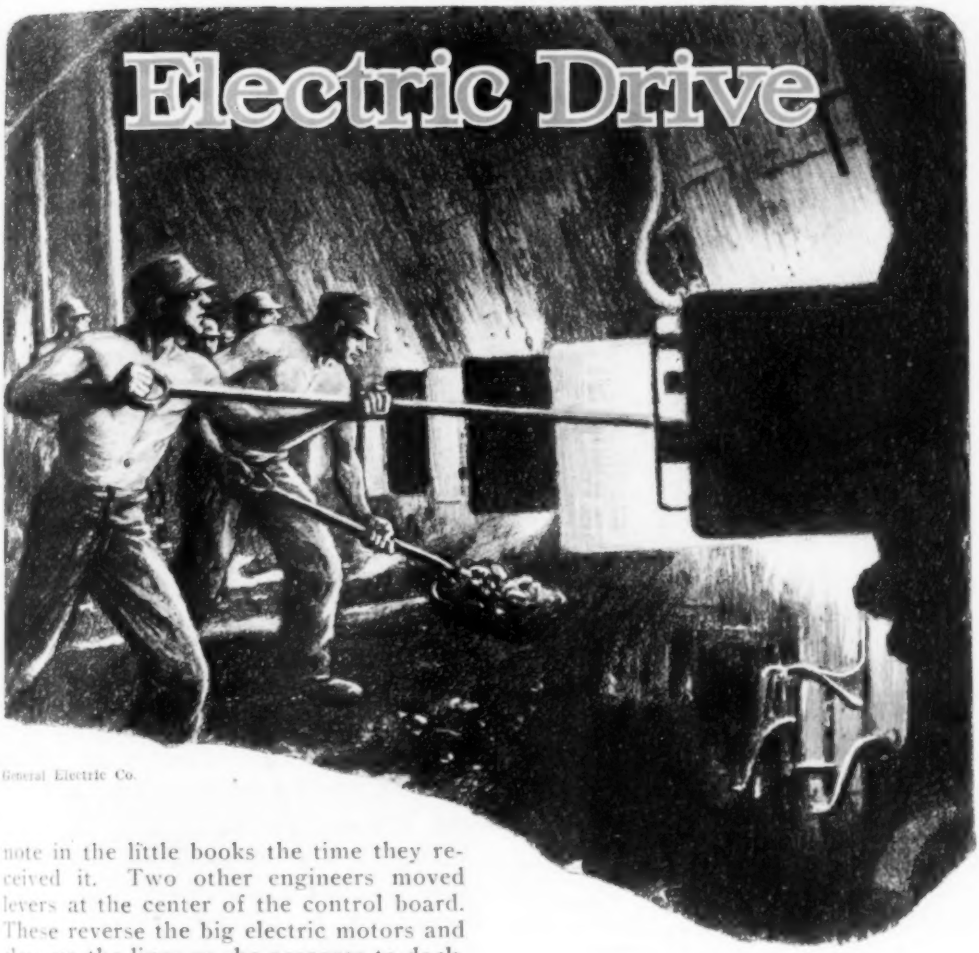
In the old days it was helm down, sheets let rip, and the canvas thundering aloft to the chant of shouted orders and old sea cries—a task to bring her up and an hour's work to pay off, trim sail, coil down and stand out to sea again.

Today, with 60,000 tons on one keel, sail replaced by sweating stokers, stokers by oil burners and turbine electric drive, guided by two fingers on a three-foot wheel on the bridge, one jangle of the engine room telegraph does the trick. In place of the "dipsey," or deep lead, is the ticking "fathometer." In less than one hundred fathoms of water it is furnishing the navigator with four accurate soundings each second.

Below decks, the engine room manifests as little in the way of motion as your automobile engine when you lift the hood. A tugboat is, in one sense, more satisfying because things are going up and down. But the engine room of a liner packs 17,000 horses into the space of a ten-room apartment. Only when you stand by one of the giant propeller shafts and watch its polished roundness winking in the light, do you get any sense of anything actually happening. It is not quiet, but there is no clash or clangor—just a constant rushing noise.

Four men stand facing the control board, their attention fixed on the many switches and dials whose faces tell the story of the ship's power from steam turbines to propellers. Behind them stand the chief engineer and the relief electrician, both checking the signals clanging down from the bridge. The "California," one of the three largest American-built merchantmen, is making port.

"Clang!—clangclangclang! Half astern!" Two assistant electricians, notebooks in hand, acknowledge on the telegraphs the signal from the bridge, then



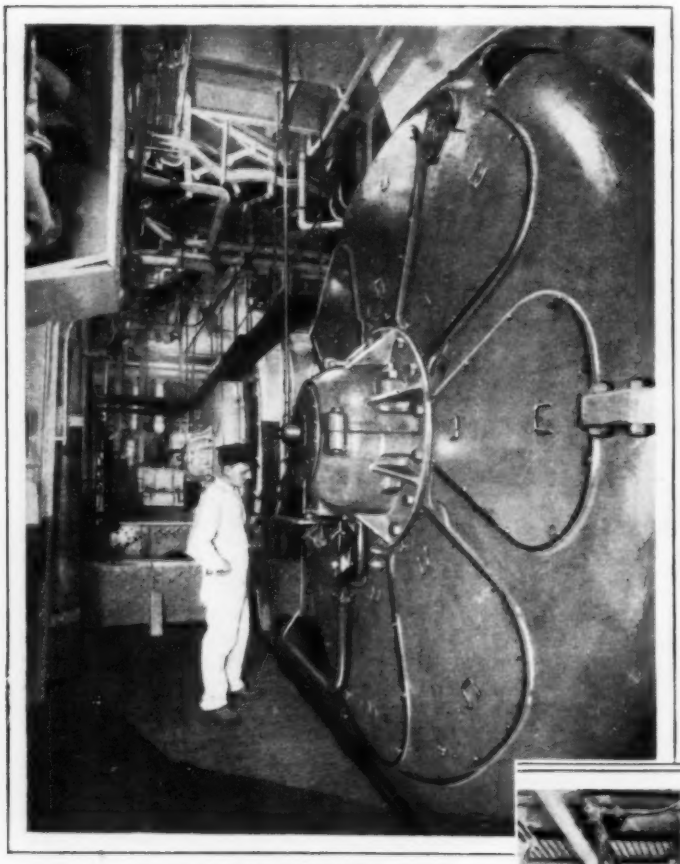
General Electric Co.

note in the little books the time they received it. Two other engineers moved levers at the center of the control board. These reverse the big electric motors and slow up the liner as she prepares to dock.

On the board Chief Engineer E. W. Bence reads the story of all the power plants that help drive the ship during the intricate maneuvers. The turbines, motors and generators—at once gigantic and delicate—sing their songs of power on the thirty-two delicate instruments that measure each change. A single slip and the 602-foot liner might crash into the dock. The twin screws, turning in reverse, slow up the vessel. Again a new command, "Stop!" and after a brief interval, "Slow ahead!" On the revolution counter the hand descends slowly to the right until the propeller is turning thirty-two revolutions a minute, one-fourth its maximum speed. Only the port screw is turning to drive the stern of the ship starboard toward the dock.

Suddenly a great clattering of bells on both telegraphs echoes around the corners of the metal walls, the indicators move up and down to the section marked "finished with engines." The chief engineer waves his hand to his assistants, levers are shoved into neutral and the crew leaves the board. The big liner is safely at dock.

As I rode at sea aboard the "California," I was conscious of no motion in the machinery. There was no sound other than the steady hum of the turbines, generators and motors. Yet 17,000 horsepower passed by the two main driving motors through 200-foot shafts direct to the screws. So delicately are these powerful engines of steam and electricity balanced that a five-cent piece placed on its edge over the bearing of one of the motors remained in its position several minutes.



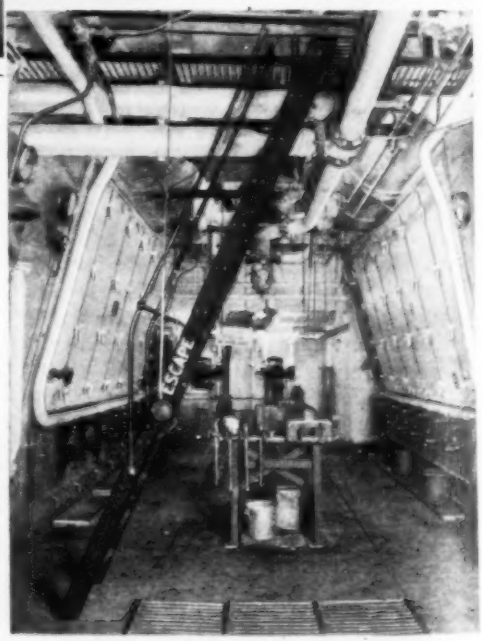
Courtesy General Electric Co.

The chief engineer of one of these electric giants of the sea—the most modern in international marine construction—moves around the engine rooms in spotless blue, directing the activities of twenty-five engineers while 500 passengers are conscious only that a luxurious liner carries them swiftly to their destination. So revolutionary are these electrically propelled ships—the three plying between New York and the Pacific coast are the "California," "Virginia" and "Pennsylvania"—that for the future, in Mr. Bence's opinion, they have relegated to the limbo of the past steam-driven ships.

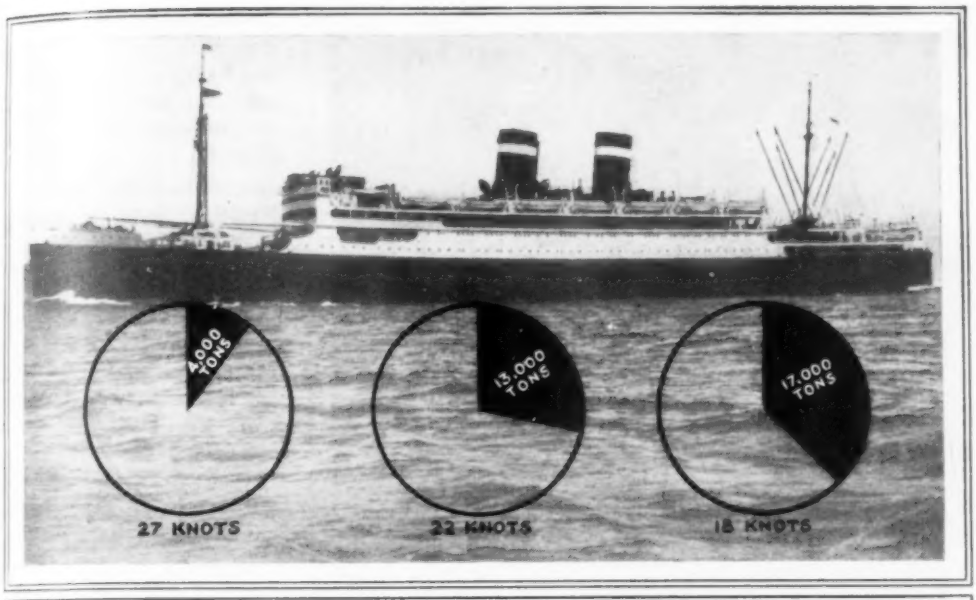
"These vessels," Mr. Bence told me, "are the largest American-built ships and the world's biggest commercial vessels propelled by turbo-electric drive. The twin driving motors, although coupled directly to the driving shafts, can be changed from full speed ahead to full speed astern or the reverse in fifteen seconds. Even then passengers on deck near the stern of the ship are not conscious of throbbing or heavy vibration.

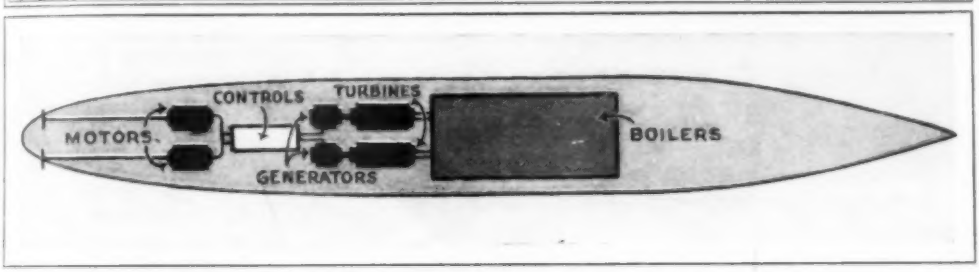
"While at sea, only one man is needed to answer the telegraph and handle the board. He marks each movement and the time in order that there may be no misunderstanding later. During runs at sea, changes with the engines are infrequent, but when we maneuver into port orders sound down from the bridge rapidly.

"Here"—he pointed to the telegraph, a circular disk marked into sections in each of which was printed words indicating the orders sent down—"is the only place on the ship we do not trust to



Above 8,500-Horsepower Motors in U.S.S. "Virginia," and View of Vessel's Boiler Room; the Motors Are Coupled Directly to the Driving Shafts





Diagrams Showing Cost of Speed; a Vessel like the "Mauretania," of 43,000 Tons' Displacement, Has Only 4,000 Tons for Revenue-Producing Purposes When Equipped for Speed of Twenty-Seven Knots; at Twenty-Two Knots, It Would Have 13,000 Tons, and at Eighteen Knots, 17,000 Tons for Passengers and Freight

electricity. The man on the bridge moves a handle which is connected to our telegraph by chain. The indicator moves as the chain transmits the order. Since it is manually operated it cannot be wrong. Then the assistant electrician moves the handle to the same point. This informs the bridge we have received and understood the order.

"A steam engineer is required to run a plant of this sort. Once the electricity is made, it becomes merely a matter of handling switches. Manufacturing the power is the process that really counts. Here we begin with boilers that make the steam that turns the turbines that drive the generators that supply electricity to the motors. These motors stand eighteen feet high and for each motor revolution the propeller revolves once.

"The principle of electric drive differs from the old method in that the whole power 'manufactured' by the motors is exerted directly to the end of the propeller shaft. On a steam-driven ship you might have an engine turning 2,000 revolutions a minute geared down to a propeller shaft turning 120 revolutions a minute. Here you would lose much of the power in the gearing.

"In the 'California,' turbines turn 2,800 revolutions a minute but they have no connection with the propellers. They merely manufacture the product that enters the driving motors through wires, serving a complete duplication on each side of the ship. Each turbine drives a generator that supplies electricity to the motor on each side. This is economical in that for cruising speeds at sea only one set of generators need be used."

At a sudden stroke, in the "California"

Chief Engineer E. W. Bence of the U.S.S. "California," Showing Size of Propeller Shaft, and, Inset, Diagram Illustrating Distribution of Weight in a Liner of 60,000 Tons' Displacement

and her sister ships, engineers have abandoned the old principle of supplying motive power to ships. The enormous horsepower generated aboard the "California" equals the manpower of 557,172 men. The turbines work twenty-four hours a day and power from the big generators is equal to the manpower of cities the size of Norfolk, Richmond, Newport News, Roanoke, Lynchburg and Petersburg combined.

"Practically," explains Mr. Bence, "electrical transmission gives us a simple and practical means of speed reduction between the high-speed turbines and the slow-speed propellers in almost any ratio we may need. Propellers are reversed, not by reversing the turbines, but by simple changes of electrical connection. The electric drive can be made noiseless whereas gears always make more or less noise.

"So successful have these early ships been that they have been copied. Seven or eight are being built in Europe and as many more are planned in the United States."

FRISCO-BAY BRIDGE HIGHEST OVER TIDEWATER

Towering 500 feet above the water at its pinnacle, the world's highest bridge over tidewater is to span San Francisco bay, linking the western metropolis with cities on the eastern shore of the bay, Berkeley, Oakland and Alameda. The structure, costing $72,000,000, will accommodate ten lanes of automobiles and interurban electric traffic on double decks, each fifty-seven feet between curbs. Six lanes of vehicles will move on the upper deck and four below, two of which will carry interurban trains. Channel spans will have a clearance of 214 feet above the high-tide mark, eighty-one feet more than Brooklyn bridge. Four main spans and the necessary approach spans will extend from San Francisco for 8,600 feet across the main channel to Goat island. From Goat island, at an elevation of 175 feet, the structure will cross a subsidiary channel with a single 750-foot span, continuing eastward on a steel trestle to the Oakland waterfront, this second section being 10,470 feet long. The maximum clearance of 14 feet will be provided between the two center spans in the main channel. Main spans will rest on concrete piers, 200 feet square, each pier being divided into four sections. Seven years will be required to complete the structure, and by 1940, it has been estimated that it will be carrying annually about 9,000,000 automobiles and 20,000,000 passengers as well as some 50,000,000 interurban and transcontinental travelers.

LETTERS PICTURES OF MOUTH IN ORIGINAL ALPHABET

That the shapes of the letters of the alphabet were first suggested by the positions of the mouth in pronouncing them is the theory advanced by Sir Richard Paget, an authority on speech. The letter "O," for instance, represented the rounded mouth; "A" suggests parted lips, especially in its original form for it was first written on its side; "M" represents two closed lips, and the letter "I" pictures the raised tongue not quite touching the palate, the dot above the letter indicating the gap, while "L" and "T" are made with the tongue actually in contact with the palate.

"MIKE" ON PHONE MOUTHPIECE CUTS OUT NOISE

Easily attached to the telephone mouthpiece, a microphone unit now on the market amplifies or modulates the voice of the speaker or shuts out interfering noise as well. This makes it possible to hear another person with less difficulty even in noisy places, and at the same time enables the speaker to talk softly or even to whisper, so that persons in the same room cannot hear, but the person at the other end of the line can. Slight pressure on a small button at the top of the unit eliminates disturbing noises, so that only the voice on the line can be heard.

HOTEL CARRIED OVER DESERT ON BACKS OF CAMELS

Camels were used recently to carry a hotel, piecemeal, across 500 miles of desert to an oasis in North Africa that had been selected as a site. Each camel carried about 200 pounds, and a caravan made the trip in forty-five days, so that many trips were required to transport all the hardware, windows, doors, glass, linen and other building materials and equipment. Only the brick could be made at the oasis.

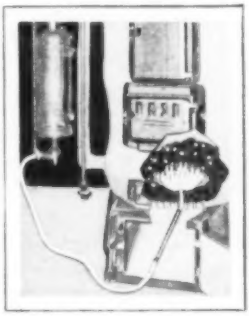
Electric Coffee Roaster with Which the Modern Housewife Can Prepare Her Own Fresh Blend

AN ELECTRIC COFFEE ROASTER FOR USE IN THE HOME

Modern housewives now can roast their own coffee in their homes with a small electric roaster which plugs into any light socket. The roaster, which insures fresh coffee at all times with little labor, consists essentially of a heating element and a revolving drum turned with a crank.

GAS LIGHTER FOR FURNACE MAKES QUICK FIRE

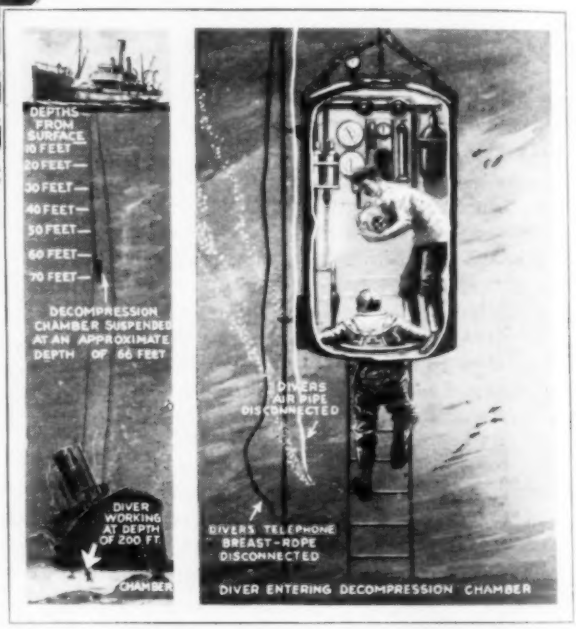
To save fuel and to make a fire in the furnace quickly, a gas line is attached to the house supply system and passed between the grates. The fuel is ignited by touching a match to the jet. This system saves dumping the grates when starting a new fire, makes the use of kindling unnecessary and reduces dust. The attachment is also provided with a spiral unit which is placed on to form an efficient flue cleaner, the gas flame helping to burn off the soot.



DIVERS GO TO GREATER DEPTHS WITH AID OF CHAMBER

Views of the Compression Chamber Used by British Divers; Dives to Fifty-Eight Fathoms Have Been Made with It

Sea dives, to greater depths than hitherto have been possible in ordinary diving clothes, have been accomplished by men in the British navy with the aid of a compression chamber recently introduced. The chamber, lowered to a depth that corresponds to the diver's first stop on his way up, is entered through the lower end while an attendant disconnects the diver's air pipe and breast rope and takes off his helmet. The lower door of the chamber is then closed and the container hoisted clear of the water. Subsequently, the pressure inside is lowered. To assist in becoming rid of nitrogen that has formed in the system during his time under water, the diver breathes oxygen while in the chamber. The decompressing process made possible by the use of the chamber, eliminates the harmful effects ordinarily suffered by dives to great depths. With this apparatus, dives to depths of fifty-eight fathoms have been made.



SOLUTION OF MAYAN MYSTERY IS SEEN IN CAVES

Scientists have been trying for years to piece together the story of the Mayas as revealed in the ruins of their pyramids, temples and monuments, and now the investigators are confronted with a new problem, a series of vast caverns in Yucatan which extend for many miles. Pictures and inscriptions on the walls indicate that the caves have been visited by human beings, but so far, archæologists have been unable to decipher the marks or establish the time when they were carved. Were the caverns used for burial places or for religious rites? Science cannot tell. There is no evidence that they were used for human habitation, although this is a possibility. A swathed mummy was reported to have been found in one of the caves, but the discovery has not been verified. Who were the people that first used the subterranean passages, and what purpose did the caves serve? Few of the many caverns have yet been explored. They are beautifully frescoed with stalactites and stalagmites, and these formations, in many places, have almost completely obscured the carvings.

PAVEMENTS OF RUBBER BRICKS STAND HEAVY WEAR

Blocks of rubber, set in a concrete base for a street pavement in 1923, have successfully withstood heavy traffic in Glasgow, Scotland, only one minor defect having been reported. This was the breaking away of the cap of one block from its tread. In London, rubber paving has been in use on New Bridge street since 1926. Although a number of the blocks have had to be renewed, the minor defects that developed did not impede traffic in any way. Between eight o'clock in the morning and eight o'clock at night, nearly 18,000 vehicles pass over the street, and there is considerable night traffic as well. The paving was laid at a cost of about $22 a square yard, without foundation.

SHIP'S PROW FOR RESTAURANT HELPS DRAW TRADE

Patrons of a San Francisco restaurant that specializes in sea foods, enter by gangplank through a portal closely resembling the prow of the "Nina," one of the ships in the fleet of Christopher Columbus. The atmosphere of the sea is further reflected by timbered pier heads, with railings of wrought iron and woven ropes. On the inside, there are also a sun deck, cabin nooks and a steering wheel.

Ship's Prow Which Forms Entrance for Sea-Food Restaurant; the Interior Also Reflects the Marine Atmosphere

© P. & A.

Metal Coat and Shield Worn by Polish Police Which Protect Upper Part of Body

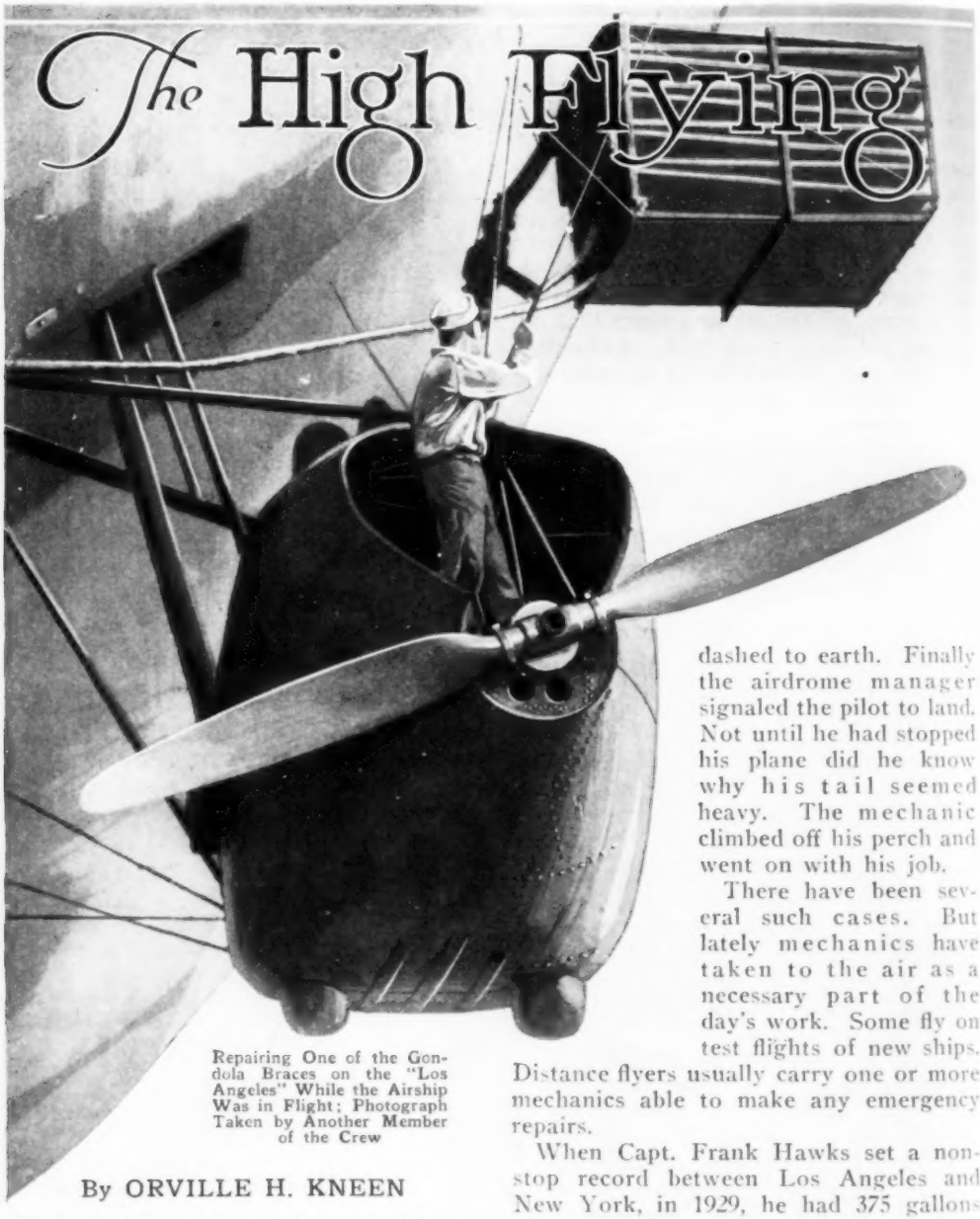
COATS AND SHIELDS OF METAL PROTECT POLISH POLICE

During recent voting riots in Poland, the police were equipped with metal coats and shields for protection. The cuirass worn by the Polish officer resembles the bullet-proof vest that is well known in this country, except that it extends below the hips, while the shield protects the neck and head.

MAGNETIC IRON PENCIL WRITES ON STEEL

Magnetized writing was demonstrated recently by a scientist who fashioned a pencil out of a piece of magnetized iron and scratched with it on a thin plate of hardened steel. In this manner he transmitted some degree of magnetism to the plate after which iron filings were dusted on it. When the plate was held in perpendicular position, the loose filings dropped off, but the magnetized parts of the plate retained their portions, making the writing on the plate clearly visible in the filings that remained.

The High Flying



Repairing One of the Gondola Braces on the "Los Angeles" While the Airship Was in Flight; Photograph Taken by Another Member of the Crew

By ORVILLE H. KNEEN

SOME time ago a mechanic in Vienna was working on top of a fuselage, at the tail. Suddenly the craft bounded forward. The startled mechanic was just able to grasp the framework as the pilot, unaware of his unwilling stowaway, took the air.

Clinging with a death grip, he tried to attract the pilot's attention, as did spectators who expected momentarily to see him dashed to earth. Finally the airdrome manager signaled the pilot to land. Not until he had stopped his plane did he know why his tail seemed heavy. The mechanic climbed off his perch and went on with his job.

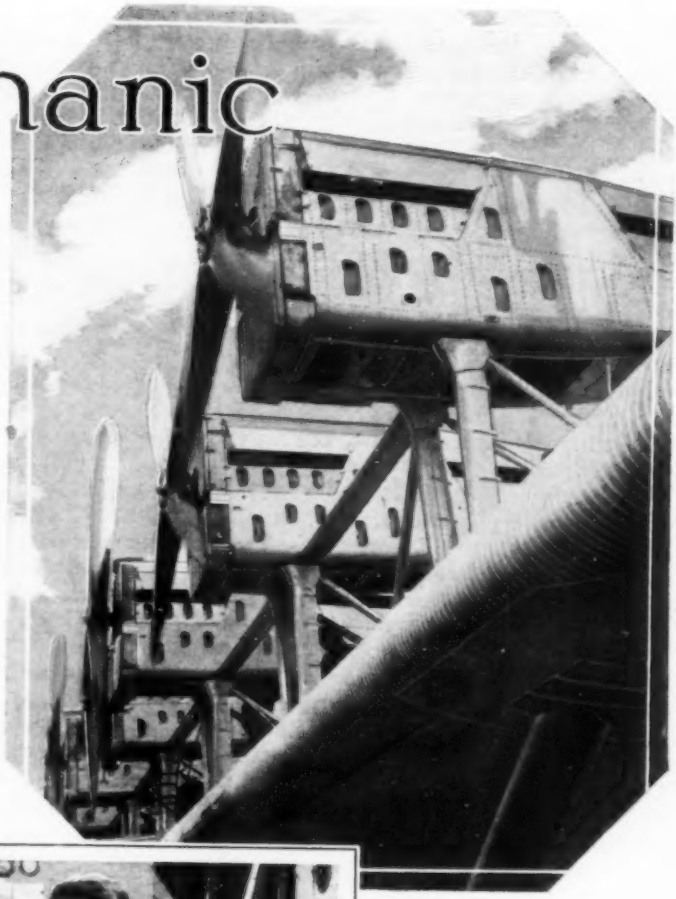
There have been several such cases. But lately mechanics have taken to the air as a necessary part of the day's work. Some fly on test flights of new ships. Distance flyers usually carry one or more mechanics able to make any emergency repairs.

When Capt. Frank Hawks set a nonstop record between Los Angeles and New York, in 1929, he had 375 gallons of extra fuel stowed in five-gallon cans in the cabin forward. The cabin was crammed full of the cans when the mechanic, Oscar Grubb, was squeezed in and the door closed. Clear across the continent, Grubb opened cans and pumped fuel for the voracious engine. Pumping his way across the continent, his only recollection was of fumes that nearly asphyxiated him. In his spare time he cut up

Mechanic

empty cans to make more room. He had no time to eat during those hectic eighteen hours of storms, fog, high winds and terrific speed.

It was the American refueling endurance flight that evolved the flying mechanic into a daring mid-air repairman. The "Question Mark," which began the contest, had a narrow catwalk on each side of the motor, on which Staff Sergeant Roy W. Hooe stood while he cleaned and changed sparkplugs. He tried to find the cause of trouble when the motor began missing badly, but the ship was then unstable and he had to desist from his search.



Some of the Driving Units of the Giant Seaplane, the Dornier "Do-X," and View inside the Craft's Control Room

For later refueling flights, therefore, plans were made to make repairs in flight. On the "Fort Worth," which next broke the record, James Kelly, former cowboy, wore a parachute as he tended the motor 2000 feet above the airport. He not only changed sparkplugs and greased rocker arms at sixty miles an hour, while balanced on his narrow plank, but he also installed a new tachometer shaft.

On the St. Louis "Robin," "Red" Dale Jackson did the catwalking, and he added a safety feature. "To check the motor," he related, "I would open the door of the cabin on either side and climb out on the six-inch wide running-board catwalk, which extended forward to within three inches of the propeller blades. The wind, far more than the height above the ground, made this difficult. For protection there were two rods rigged as railings outside me, and I had a safety belt with a ring which slid along the lower of these

rods. Once I was in position, it was not so hard to do the work, because old man O'Brine certainly did hold the ship steady. He knew that one slip by me, standing there without a parachute, would mean certain death."

Even more spectacular, to the thousands watching below, was his trip to the tail. Forest O'Brine, at the controls, said it was even worse to watch than when "Red" went out on the catwalk. Jackson climbed out on top of the fuselage, and then slid back, the pilot "feeling" his progress by his elevator control. The repairs completed, Jackson swung over on his stomach astride the fuselage, put his feet against the stabilizers, and worked his way forward into the cabin.

But the worst was yet to come. At 3:00 a.m. on the eighth day, when only half through the long grind, the motor started cutting out and vibrating heavily. "Red" was asleep. He awoke instantly, and in a few moments was out on the catwalk, flashlight in hand. He changed spark-plugs in two lower cylinders. He had hardly got back when the motor again went bad. He checked over the magnetos and oil-soaked wiring, and burnt his hands severely. He kept on in spite of this, for the flight was in imminent danger. The breaker points of the left-hand magneto he found to be grounded in the base. While it rotated at high speed, he fished out a small piece of wire, and the motor settled down to its steady roar. After a while a pushrod began spraying oil, and this was mended. Once O'Brine got a gasoline shower bath when the refueling planes suddenly were separated by the backwash from another plane. Their light 170-horsepower motor was apparently as good as ever when they landed, after 420 hours seventeen minutes aloft.

The "City of Chicago" monoplane, piloted by John and Kenneth Hunter, had a catwalk on which Kenneth, a former wing walker and parachute jumper, "doctored up" ailing cylinders and kept all parts lubricated. One of his exploits was clearing the tail of masses of paper, string and other debris which had blown back and caught in wires, rudder and stabilizers, with imminent danger of clogging the controls. Kenneth crawled out, head first, from the hatch, slid backward on the fuselage, and hung to a rope while he cleared away the debris. A lurch of the plane would have pitched him off, and he wore no parachute.

During the night of July 1, the motor coughed and spluttered. At 2:00 a.m. John went out on the catwalk and put a new breaker into the magneto, restoring the steady drone. On July 3, an engine holding-down bolt dropped out. Kenneth obtained a new one and from the catwalk put it into place.

The next attempt to break the Hunters' record of 553 hours, at Roosevelt field,

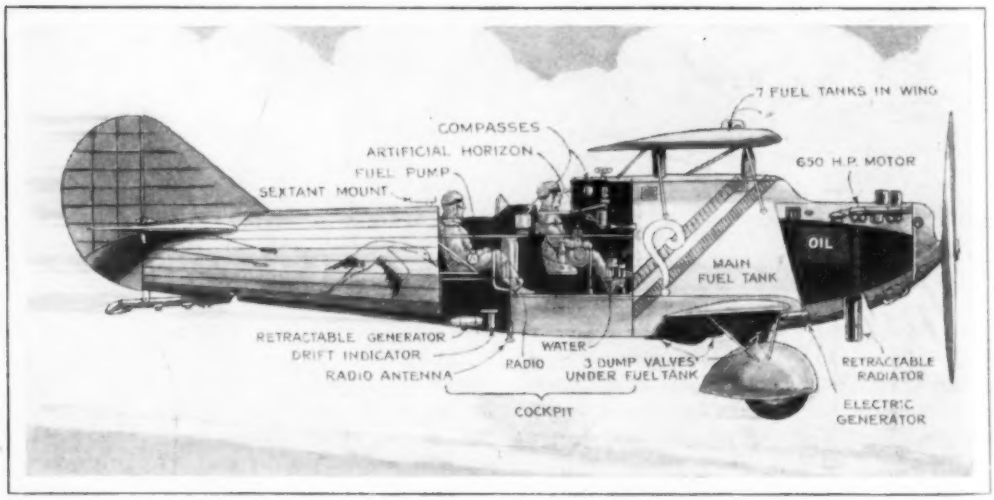


Diagram of Captain Coste's Now World-Famous "Question Mark," the First Airplane to Make a Non-Stop Trip from Paris to New York

Captain Frank M. Hawks over Los Angeles in His Fast "Texaco No. 13" Monoplane in Which He Has Made Several Transcontinental and Shorter Trips in Record-Breaking Time

almost came to grief before it was half completed. The motor began to miss badly. Changing sparkplugs failed to remedy it. Finally a battery was sent up, for possible use, and the plane climbed to a high level while the mechanic crawled out of the window onto the catwalk.

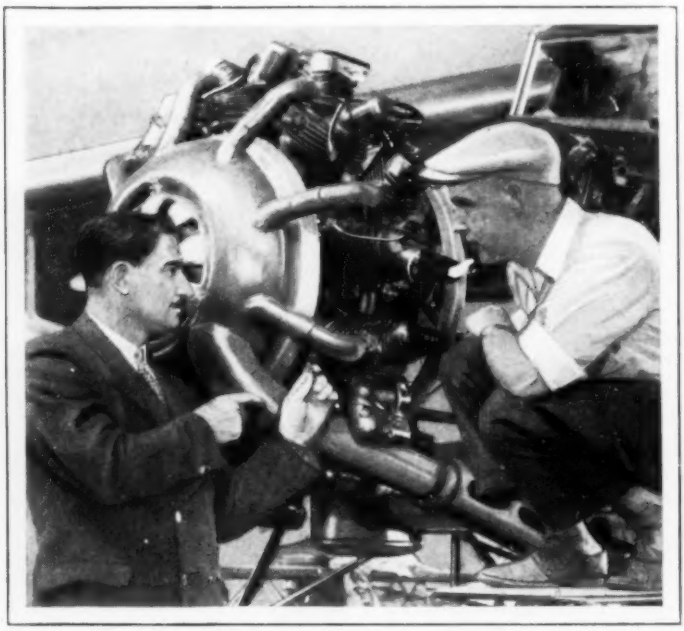
Hanging to a short rope with one arm, he put one foot on the propeller, to prevent its turning with the wind as the engine was cut off and the plane glided. He then installed a new breaker-point assembly, restoring power at once. By a higher climb, a repair job of five or ten minutes could thus be made.

A couple of years ago, the "Graf Zeppelin," on its way across the Atlantic, ran into a storm and lost some 717 square yards of fabric from the underside of the port stabilizing fin. This occurred about 1,000 miles from Bermuda. The speed was cut in two, and two helmsmen, one of them Knut Eckener, son of the commander, volunteered for the dangerous and unique job of re-covering the fin.

They crawled out on top of the great air cruiser, then made their way to the damaged fin. Buffeted by wind and rain, they clung to the framework and made an emergency repair job, running imminent risk of being pitched headlong into the sea. Earlier in this voyage, while over the Madeira islands, a mechanic climbed out on top of a motor gondola to repair a damaged oil tank.

Oddly enough, the British dirigible "R-100," on its way to Canada in July of this year, had almost exactly the same accident while over the St. Lawrence river. A sudden strain ripped the fabric from the underside of the port fin. A rigger, named Flatters, crawled out through the torn hole and made the fabric fast to the undamaged part.

The great Dornier "Do-X," which flew on one test flight with 169 persons aboard, is the first aircraft to provide mechanics and facilities for regular repairs in flight. A tunnel in the huge wing leads to the six nacelles which carry the twelve tandem motors. An engine man at each nacelle starts his two engines with compressed air. The four men in the outer nacelles stay there during flight. There are



Inspecting the Wright 300-Horsepower Engine of the Mendell and Reinhart Plane before Trying for 1,000-Hour Endurance Record

twelve American motors, each of 600 horsepower.

The great airliners, airplanes and airships of the near future will carry spare parts, repair mechanics and equipment to provide for all ordinary repairs in flight. Possibly even a spare motor can be carried. A round trip across the continent will take twenty-four hours or less, with huge airliners refueled in air to save time. Anthony H. G. Fokker said recently:

"It is now certain that, as the size of the plane increases, the engines will be made more accessible to provide facilities for making minor repairs in the air. It may be possible in the future, on larger planes, to transfer complete engines, and even crews."

MICROPHONE IN GASOLINE TANK CATCHES A THIEF

Using a microphone for a burglar alarm, an Englishman in India recently caught a thief who had been pilfering gasoline from his private tank. The microphone was attached to the tank and two wires were extended to the owner's bedroom. When a gurgling sound was transmitted, the owner dashed to the tank and found a native filling a can.

LIGHTWEIGHT TILE IN COLORS MADE AT LOW COST

Earthenware and tile, light in weight and brilliant in color and design, are being made in Germany, and the process is being introduced in this country since it is less expensive than ordinary methods of tile making. The product is known as "sedilith" and is in reality an artificial stone, composed of sand and lime and a chemical to act as binder. Neither heat nor pressure are used in making the tile, yet they are waterproof and weather-resistant. The product is lighter than stone, concrete, porcelain or clay tile and has a greater tensile strength. The liquid material is poured in molds and hardens in twenty-four hours without warping, so that masks, statuary and moldings retain a clean-cut appearance. The coloring processes are likewise inexpensive. The tile can be made anywhere, once the equipment is obtained.

ELECTRIC BELT SANDER CUTS WITHOUT RIPPLES

Assuring an extra-smooth finish through the use of a flexible pad, an electric belt sander can now be employed on wood, metal or stone surfaces. The front roller is adjusted on an eccentric shaft with spring tension which permits quick changing of belts. Tension is controlled by a handwheel, and a thumbscrew adjustment provides perfect alinement of the belt on the rollers. The machine is well balanced, and ball bearings are used throughout. The motor is air-cooled and the belt runs with a free speed of 1,700 feet per minute. The weight is only eighteen pounds.

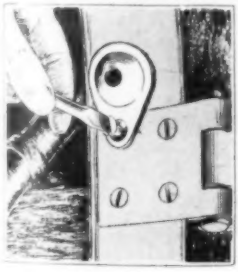
ANIMALS IN AMERICA FIFTY THOUSAND YEARS AGO

© Field Museum of Natural History

Reproduction of Painting Depicting Beasts and Birds of Prey, Now Extinct, Surrounding a Tar Pit and Fighting for the Privilege of Feeding on the Animals That Have Become Mired in the Pit

Until only a few years ago, animals were sometimes trapped in asphalt pits near Los Angeles, being unable to extricate themselves after falling into the sticky substance. There is abundant evidence that the pits formed a natural hunting ground for wild animals some 50,000 years ago. Saber-toothed tigers, wolves and vultures of species now extinct fought to claim the carcasses of other animals that had perished in the asphalt. A painting, representing a possible scene at the pits, has been made by Charles R. Knight for the Field Museum of Natural History. It shows three saber-toothed tigers devouring a carcass and defending their prey from a flock of vultures.

AUTO-DOOR RATTLES STOPPED WITH AIR CUSHIONS



Pneumatic cushions made of rubber now are provided to stop the rattles that often develop in automobile doors. The squeak eliminator is a rubber tab with an air-cushion center, and is installed by removing one screw from a door hinge, inserting it through a hole in the cushion and replacing the screw. This holds the door firmly on a cushion of rubber and stops the squeaks by eliminating the friction

ULTRA-SHORT RAYS IN RADIO ACT LIKE LIGHT

Ultra-short radio waves, having a length of four inches, or one-tenth of a meter, and less, have been produced by a German scientist and have been found to have very individual characteristics. They are undamped, absolutely unmixed with waves of other lengths, and follow strictly the laws of light rays as to reflection and in many other important respects. Particularly interesting is their penetration. Without appreciable loss in strength, waves of fourteen-centimeter length pass through a layer of paper one-half centimeter thick, or the same thickness of hard rubber and paraffin oil, but are almost entirely stopped by distilled water. One of the immediate practical applications of such waves may be to radio "lighthouses" where their purity and obedience to optical laws have obvious advantages over the longer waves.

Golf Scorer on Club Handle Which Punches Holes in a Score Card to Keep Track of Strokes

GOLF SCORER ON CLUB HANDLE KEEPS STROKE COUNT

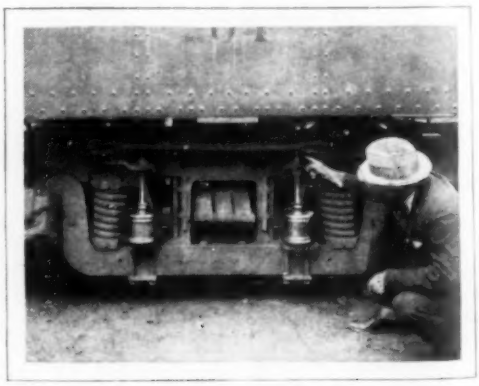
Attached to the golf-club handle where it is not in the way and does not interfere with the stroke, a unit that registers the score has been introduced. With each stroke, the player presses a little button which punches a card at the indicated number of the hole. This saves using a pencil. At the end of the game, the player has a graphic record of the score shown in small perforations in the card, which is taken out and preserved if desired.

LAKE TO COVER TOWN ON SITE OF BAGNELL DAM

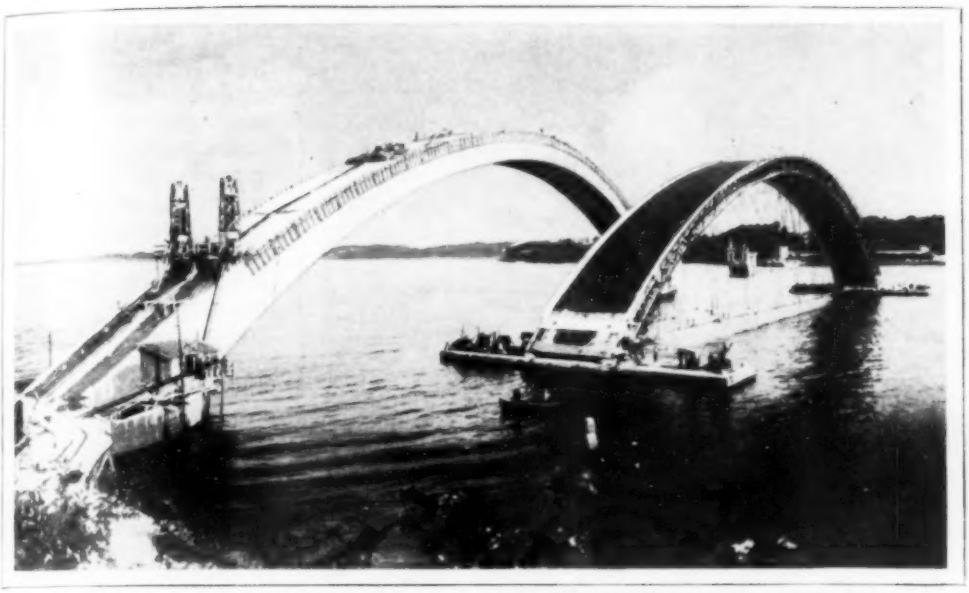
Linn Creek, a village of 550 inhabitants in central Missouri, will be buried under sixty feet of water when Bagnell dam starts impounding the waters of the Osage river as the final step in a $30,000,000 hydroelectric project. The people of this town are moving out as are those occupying about one-third of Warsaw, Mo., which likewise will be under water. About 1,400 farms, forty-two cemeteries and thousands of acres of timber land will be covered by this man-made lake, which will supply the water for a plant generating more than 200,000 horsepower. The dam is to extend 140 feet above rock bottom, and the level of the lake will be 108 feet above the water below the dam. A state highway will run over the top of the dam, and the lake will be 140 miles long. Linn Creek, county seat of Camden county, contains about 100 buildings most of which have been bought by the power company and will be destroyed or moved. One of the biggest tasks is the moving of the cemeteries, entailing search for relatives of the dead all over the world.

AIR TO SMOOTH RAIL SHOCKS WITH NEW ABSORBER

Atmospheric pressure is utilized initially on both sides of the piston in a pneumatic shock absorber adapted to automobiles, and also for heavy-duty work such as busses and railway cars. The air pressure on either side of the piston increases very rapidly upon movement in either direction until a predetermined pressure is reached, at which time the air is by-passed to the opposite side of the piston so that pressure is built up for the snubbing action. This prevents the quick recoil of the springs which would occur should a partial vacuum be established in the snubbing direction. The apparatus also prevents axle roll, making steering easier, and absorbs the shocks before they are transmitted to the steering mechanism. For trains, the same principle is used except that the train line or an auxiliary line of compressed air is employed for initially applying a considerable pressure on each side of the piston when it is in its normal position.



Pneumatic Shock Absorber on Railroad Car Which Utilizes a Cushion of Air to Eliminate Jars



To the Right Is a Form for a 600-Foot Concrete Bridge Arch Being Conveyed into Position on Pontoons; at the Left, One of the Completed Arches of the 2,600-Foot Bridge

ARCHES FOR CONCRETE BRIDGE FLOATED INTO POSITION

When work was started on a 2,600-foot concrete bridge near Brest, France, one of the problems faced by engineers was the placing in position of three 600-foot arches. After the first arch had been finished, a huge arched form for the central one was made and floated into place on pontoons. After the form was in position, the job of pouring the concrete was comparatively simple.

STEEL TOWER ONE MILE HIGH IS FOUND PRACTICAL

If such a structure would be of any value, it is entirely practical from an engineering standpoint to construct a steel tower one mile high. Such a structure, according to Gilbert D. Fish, structural engineer for the Westinghouse Electric and Manufacturing company, would require 19,000 tons of steel, would stand on a base 528 feet square and have four main posts, each composed of a cluster of columns arranged in the form of a square with twenty-foot sides and tied together with diagonal members. Each post would rest on a foundation, twelve feet thick and eighty-five feet square, containing 3,250 cubic yards of concrete. The steel members would be joined by arc welding because that process would be the most economical for both construction and maintenance, and would insure extra stiffness, due to the absence of slip and play in the joints.

RUBBER STOPPER FOR BOTTLES WITHSTANDS PRESSURE

Rubber bottle stoppers that will withstand a pressure of fifty pounds are proving particularly useful for retaining carbonated beverages. The cork is of flexible rubber with a grooved surface and a hollow center, and a protecting top that turns down over the edge of the bottle. Action of the grooves and the turn-down top combine to cause the stopper to grip the glass firmly and thus effectively prevent escape of the gas with which the beverage is charged.

Floral Clock in an English Garden; the Mechanism Is under the Hands; Flowers around the Border Indicate the Minutes

HUGE CLOCK BUILT OF FLOWERS KEEPS ACCURATE TIME

In an English garden a Cheltenham watchmaker has made a large floral clock that keeps accurate time. The clock is set in a fenced plot of ground with decorative borders. The operating mechanism is in a base in the center to which metal hour and minute hands are attached. Numerals on the clock's "face" are made of flowers and about the circumference are sixty small flowers to represent the minutes as the hands revolve over them.

PLANES ARE FOUND AT NIGHT BY GLOW OF EXHAUST

To locate airplanes in flight at night, an instrument similar to the apparatus used by astronomers to measure the heat intensity of distant stars has been built. The hot exhaust pipes of a plane give off infra-red rays which are invisible but are able to penetrate fogs and clouds. A detector instrument, sensitive to these rays, searches the heavens for them, and when they are picked up, it is turned until the highest reading is obtained. When this is ascertained, the device is known to be trained on the ship. The readings on the course and altitude dials then are transmitted to anti-aircraft guns. With this apparatus, there is no brilliant searchlight beam, which often only aids the enemy birdman in locating his objective.

WAX AND POLISH PREVENT AUTO SUNBURN

Automobile finishes suffer from sunburn just as the skin does, and, unless properly protected, the finish behaves in much the same manner as the sunburned skin. Appearance of the finish is altered by the weather in two ways. First, a thin film of dirt accumulates and is baked on the finish by the sun and engine heat, and the finish itself becomes dull from exposure. Ultraviolet rays are most destructive to the finish, just as they are to the skin that burns. There are two ways of prolonging the life of the finish, for even the best finishes of today do not last forever. One way is to protect the finish from the sun as much as possible, and the other is to wax and polish the body. Aside from protecting the surface, the wax does not permit the penetration of the ultraviolet light. For this reason waxing in summer is even more important than in winter, but the wax should be applied only on an entirely clean surface which has been polished.

¶ Black has succeeded blue as the favorite color for automobiles.

When Seeing is Deceiving

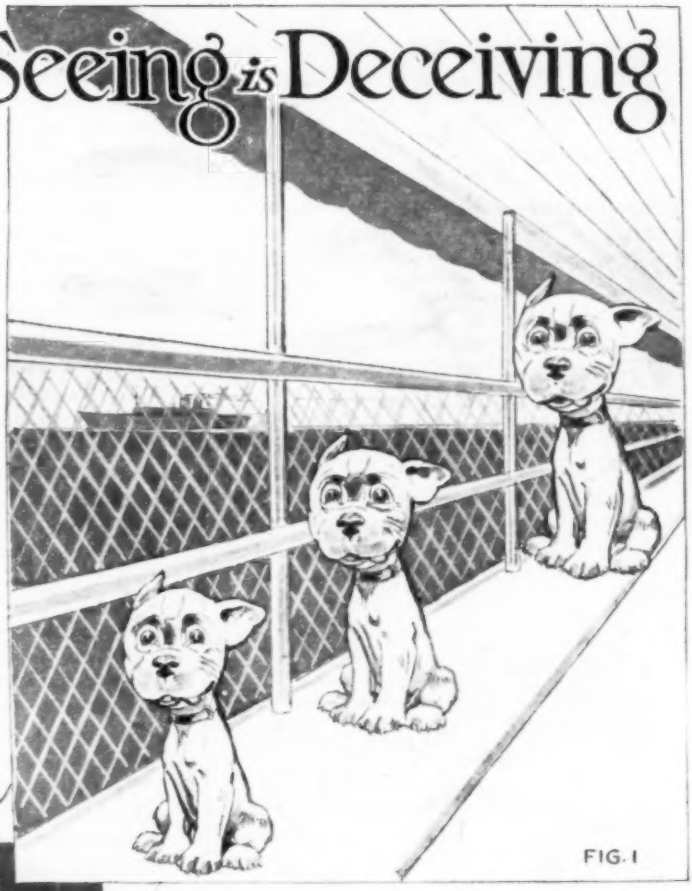


FIG. 1

THE familiar saying "seeing is believing" might well be changed to "seeing is deceiving." It is taught from childhood to university that we see with our eyes, and this is the truth but not the whole truth. Indispensable as are the sense organs in gaining an acquaintance with the world within which we live, yet they alone do not determine how extensive or how accurate that acquaintance is.

There is a mind behind the eye which guides in gathering information, and gives value and order to the exercise of the sense of sight or vision. How true this is of vision—the most intellectual of all the senses of man, the one in which mere acuteness of the sense organ counts least and the training in observation most!

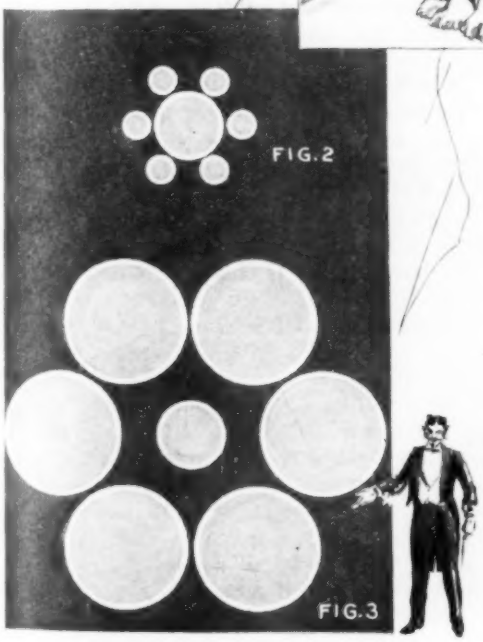


FIG. 2

FIG. 3

Seeing or observing is a double process, partly objective or outward and partly subjective or inward—the picture mysteriously transferred to the mind's representative, the brain, where it is received and affiliated with other images.

The importance of the mind's eye in ordinary vision is also well illustrated in cases where we see or seem to see what is not really present, but what for one cause or another is natural to suppose is present. For illustration, take the word "Detroit" in one of the drawings. We see only the general outline of the word, and the detailed features are supplied from within; in this case, it is the expected that happens.

FIG. 4

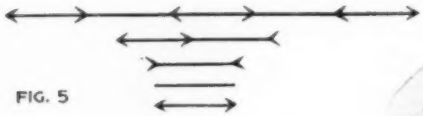


FIG. 5

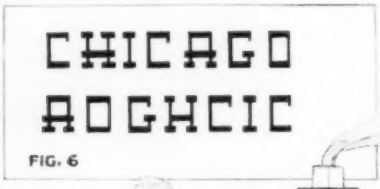


FIG. 6

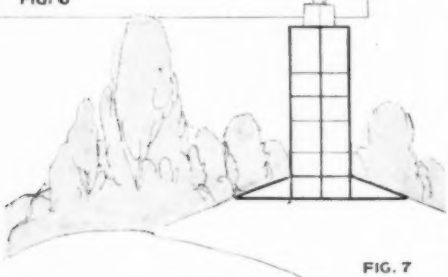


FIG. 7

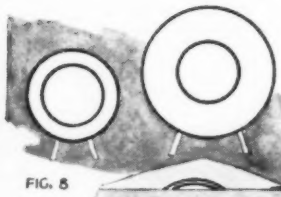


FIG. 8

FIG. 9

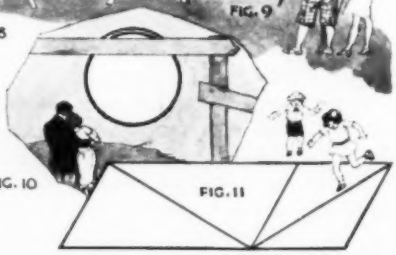


FIG. 10

FIG. 11

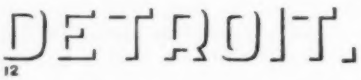


FIG. 12

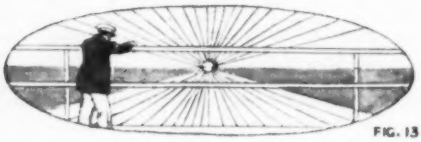


FIG. 13

The center circles of Figures 2 and 3 are exactly the same size, although the center circle in Figure 2 appears much larger than the center circle in Figure 3 because of the size and positions of the circles surrounding them. In Figure 4, the two horizontal lines are parallel but appear to diverge toward the ends due to the oblique lines intersecting them.

Despite all precautions taken in observation of many illusions of length or size, it often becomes necessary to employ an objective quantitative test or measuring device, and only by the application of such a device can the fallacy of the illusion be determined. In Figure 5 are a number of lines drawn between arrow heads, and in each case, every line between the arrow heads is equal. No one would judge these lines as equal, but by applying a rule, their equal length will be disclosed.

The fact that we can perceive at once only as many items as can be unified in one total impression, may be shown by Figure 6. Glance at each of the two groups of seven letters. The first group is perceived at a glance, the second series can not be fully perceived at once.

Vertical lines seem longer than horizontal lines, as illustrated in Figure 7. Here, the bottom horizontal line is exactly the same length as any one of the three vertical lines although it appears much shorter.

The inside circles of Figures 8 and 9 are exactly the same size, although the inside circle of Figure 8 appears much larger than the inside circle of Figure 9. In Figure 10, the lower arc above the parallel lines is a portion of the circle.

In Figure 11, the large parallelogram is divided into two smaller ones and a diagonal placed in each. The diagonals are equal in each parallelogram, although the diagonal on the left appears to be much longer.

The word "Detroit," Figure 12, appears at a distance as a double-bordered letter word, but upon careful examination, it is found to be made up of a single border of lines. We see only the general physiognomy of the word when we glance at it, and the detailed features of the word are supplied from within.

In Figure 13, the two broad lines are

parallel, but they certainly appear to diverge from the center, due to the numerous lines intersecting them at different angles.

In Figure 1, we have three dogs, all identical in size and shape, but due to perspective, we see the one farthest from us as being the largest and the one nearest as being the smallest.

In general, we do not see things as they are; that is, the intellect does not correctly interpret the messages of the visual sense, although sometimes the optical mechanism of the eye is directly responsible for the illusion. In other words, none of our conceptions and perceptions are quite adequate, but fortunately most of them are adequate for practical purposes.

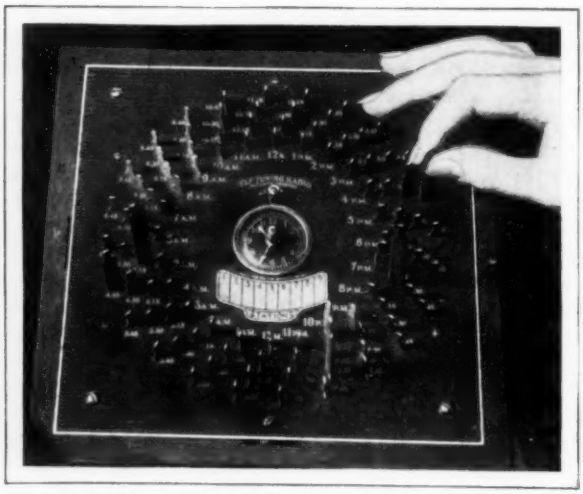
MAN LOOKS INSIDE A TORNADO AND TELLS WHAT HE SAW

Probably the only man who has ever seen the inside of a tornado and lived to tell it, is a Kansas farmer whose experience has been reported to the weather bureau at Washington. He noticed the approach of a dark cloud consisting of three tornadoes, and hurried his family to the cyclone cellar, then paused at the entrance to watch the largest and nearest of the funnel-shaped clouds, ready to duck inside if necessary. As he watched, he saw the lower end of the tornado rise, the tip gradually ascending until the great shaggy end of the funnel was directly over his head. There was a screaming, hissing sound coming from the funnel, and as he gazed upward, the farmer was astonished to be able to peer through the center of this funnel directly into the heart of the disturbance. The funnel opening he estimated at about 100 feet in diameter, and he looked up through this for about half a mile, the spectacle being made visible by vivid flashes of lightning which zigzagged from side to side of the whirling wall of clouds. Around the lower rim of the great vortex, smaller tornadoes were forming and breaking up, and these made the hissing noise. The rotation of the great twister was counterclockwise, but the small whirls moved both ways. The opening appeared entirely hollow, except for something that looked like a detached wind cloud which moved up and down constantly.

APARTMENTS BUILT IN CIRCLES FIND FAVOR IN GERMANY

Circular housing plans for apartment buildings are finding favor in Germany. In a suburb of Leipzig an architect has constructed more than a score of apartment buildings, built in three concentric circles to form one large unit. The buildings are constructed in circular segments, and two common drives run diametrically through the settlement, with tributaries branching to the various buildings.

More Than Twenty Apartment Buildings Are Contained in This Circular Housing Plan Carried Out in Leipzig, Germany; the Units, in Concentric Circles, Have a Street System in Common



Radio Control Board Which Turns Set On and Off and Tunes in Stations at Any Time Designated

RADIO-CLOCK CONTROL TUNES STATIONS IN ADVANCE

Making radio entirely automatic in operation, an electric clock with a control-board attachment makes possible the tuning in of stations chosen in advance. By a system of plugs on the control board, the set can be turned on or off at any designated time selected in advance, and any station desired can be tuned in at any designated time, thus enabling the setting of the control board to pick up the programs desired from different stations for an entire evening.

RUBBER VASES FOR FLOWERS DO DOUBLE DUTY

Flower vases of rubber answer a double purpose, for they not only are unbreakable, but can be shaped to conform to the length of the flower stems placed in them. By a mere pressure with the palm of the hand, the rubber vase can be elongated for the long-stemmed flowers, or shortened for other kinds. They are made in several different solid colors as well as in mottled effects to suit individual tastes.

GLASS IS CONSIDERED A LIQUID

Glass is a liquid and not a solid, in the opinion of George W. Morey, of the Carnegie Institution at Washington. He describes it as being in a state of "suspended animation" and suggests that, because of the limited number of ingredients in the world that will produce this effect, it is little wonder that the secrets of making glass were so zealously guarded in early times, and that the product has been shrouded in mystery and secrecy from the beginning. The three substances that make glass, lime, soda and sand, must be mixed in the right proportions or the material becomes worthless. It is only recently that scientists have determined the true nature of glass.

CELLULOID CURTAIN FOR AUTO SHIELDS EYES

For the windshield or rear window of the auto, a glare shield now is available to shade the eyes from sun or lights of other cars. It is a celluloid curtain on a frame that is attached to the glass with vacuum cups. It rolls up out of the way when not in use, and is attached or taken from the windshield in a second.

SIX MILLION RIVETS IN AIRSHIP

Workmen building the navy's newest Zeppelin-type airship "Akron," are driving 6,500,000 rivets into the framework without striking a single blow. The rivets are made of aluminum alloy instead of steel, and are squeezed into place instead of being pounded by compressed air or electric hammers.

SPEAKER PRODUCES CHIMES WITHOUT ANY BELLS

Chimes without bells and a reproduction of the booming of Old Ben in London are two of the features heard regularly by residents of Camden, N. J., through a giant loud speaker in the courthouse tower, 300 feet above the street. The speaker has an audible radius of from two to six miles and programs can be broadcast through it to an entire city, using either a microphone or phonograph records. From an ordinary inexpensive record, chimes of a famous Belgian carillon are reproduced, and another instrument gives the effect of a huge bell striking the hours. A small box, less than a foot square, supplies this sound through oscillations. On three sides of the tower are banked 180 loud speakers with a capacity of 600 watts, arranged at angles. Through the speaker a mayor can make a proclamation, or a band or orchestra concert can be offered for the entire population.

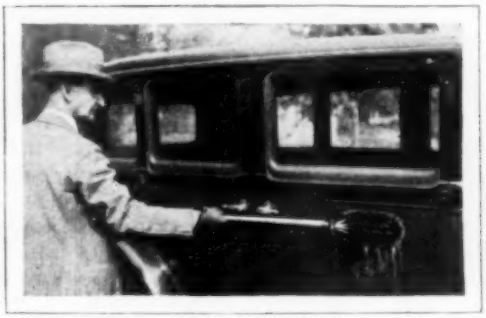
Unloading a Ninety-Ton Gun Turret in the Harbor of Sydney; the Australian Navy Expects to Use This Huge Mounting as a "Spare"

GUN TURRET USED AS "SPARE" BY AUSTRALIAN NAVY

Like the careful motorist, the Australian navy believes in carrying a "spare," although in the navy's case it is a gun turret that is the emergency equipment. The huge turret, weighing more than ninety tons, was unloaded recently in the harbor at Sydney after it had figured in diplomatic correspondence because foreign powers had photographed it while the vessel that carried the mounting was on its way to Australia through the Mediterranean.

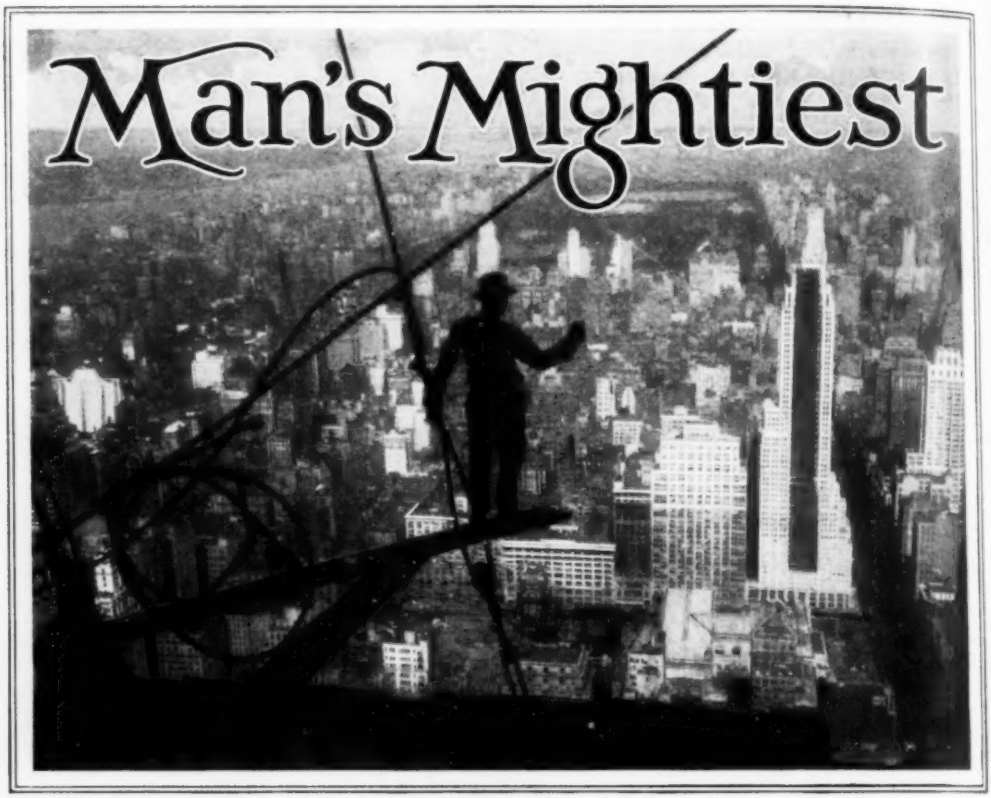
FOUNTAIN-BRUSH AUTO WASHER ATTACHED TO GARDEN HOSE

Washing the car is simplified with a fountain brush of soft bristles having a long handle which attaches to any garden hose. The brush removes all dirt quickly and thoroughly. It is also suited for washing the outside of windows, etc.



Fountain-Brush Auto Washer with a Long Handle Which Can Be Attached to Garden Hose

Man's Mightiest



Workman Gazing over Manhattan from the Eighty-Eighth Floor of the Empire State Building; When Completed, This Building Will Be the Tallest Man-Made Structure in the World

VISIBLE fifty miles out at sea, 100 miles from an airplane and seventy miles north of New York, a $50,000,000 miracle of glass, steel, chromium, aluminum, limestone and granite commands the horizon and staggers the imagination.

Not a mirage, but a colossus of modernity, is this, the highest structure ever reared by mankind, fulfilling myriad prophecies on time, space and infinity.

The Empire State building, 1,250 feet from sidewalk to aviation beacon, ushers in the age of Babylonian pinnacles and presages severe restrictions on the term "skyscraper." One thousand feet above Fifth avenue, on the eighty-fifth story, you can see how this new Goliath dwarfs so-called skyscrapers of twenty stories.

Beginning at the ground floor, the Empire State occupies a site of 83,725 square feet, or 197 by 425 feet. The main setback, sixty feet, occurs above the fifth story. From the sixth story, there is a sheer rise of almost 1,000 feet, all surmounted by an airship mooring mast 200 feet high. The total volume is 37,000,000 cubic feet, 2,000,000 square feet of rentable space for 20,000 tenants, and enough spare room for 15,000 visitors.

These mammoth proportions fade, however, before the distinction of being the first building constructed to accommodate aircraft and their passengers. The Empire State's mooring mast may not be used for three years, but everything will soon be in readiness. Exhaustive studies are now being made of various types of mooring machinery. The 200-foot mast is faced with glass and chrome-nickel steel. The framework is reinforced and fastened rigidly to the main building skeleton. A fifty-ton jolt would not injure the mast or substructure, and it is doubtful whether any dirigible at ease could jar this anchorage.

R. H. Shreve, the architect, intends to follow new developments in mooring machinery. He referred to the graphic il-

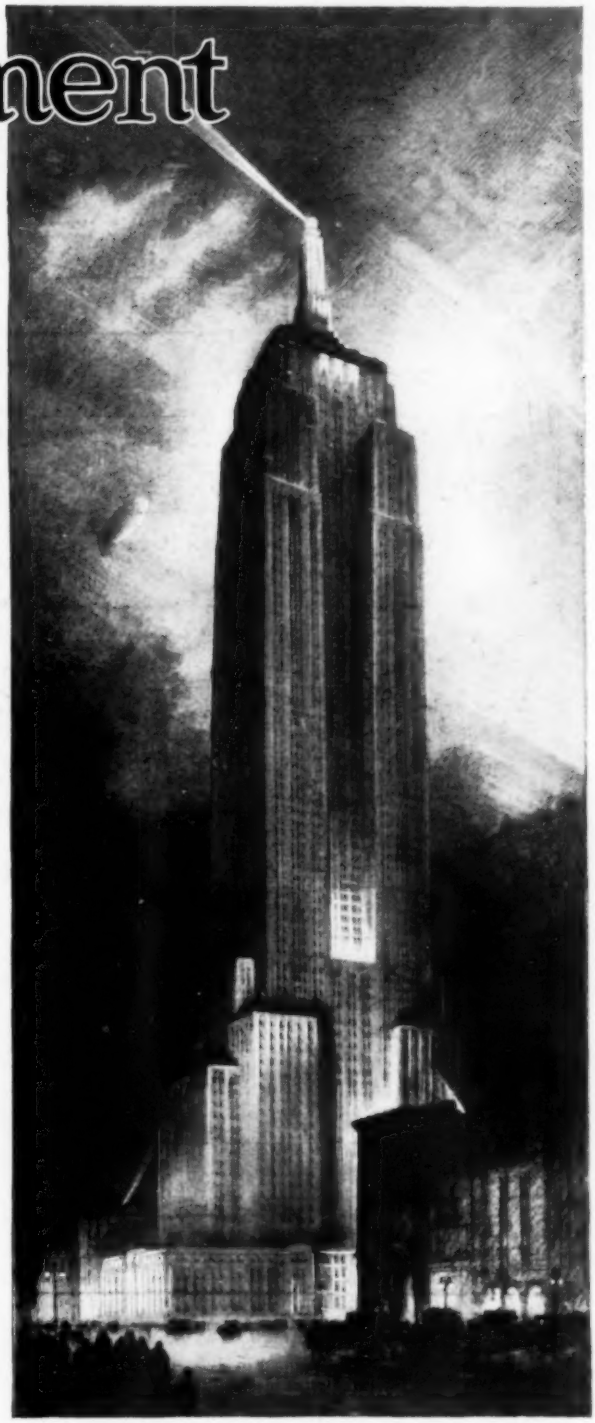
Monument

lustration of the mooring-tower head at St. Hubert's airport, Canada, which appeared in the October issue of Popular Mechanics, saying that it would be installed if no improvements are made while the choice is pending. Meanwhile, the tip of the mast will be an aviation beacon, which will be discarded when the type of mooring apparatus is selected and installed.

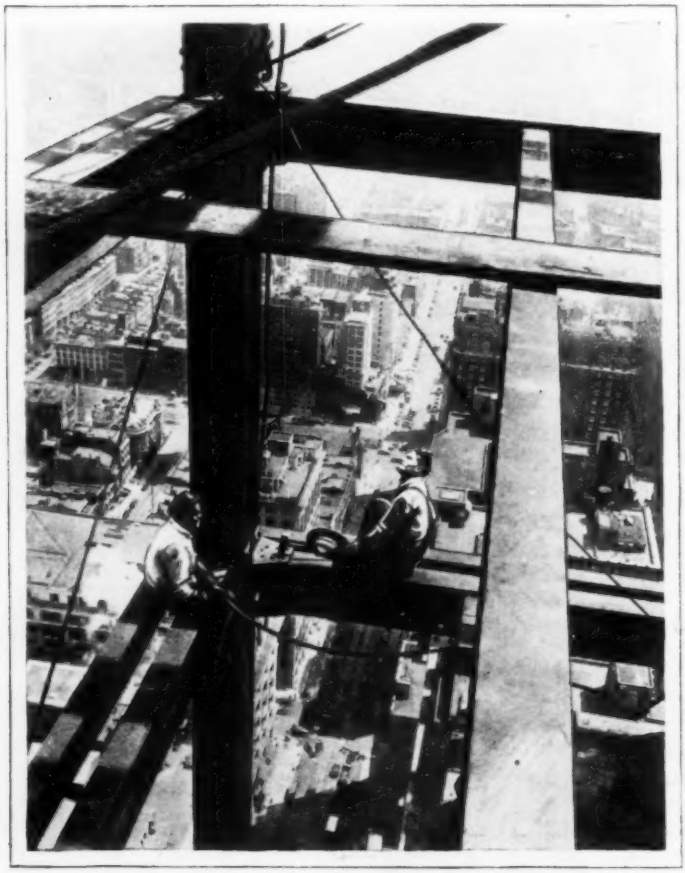
The building's elevator contracts involve an expenditure of $3,000,000. No firm ever before attempted a 1,000-foot elevator altitude in a building, and the project necessitates elaborate experimental work. Certain phases of construction will cost the elevator builders three times what they receive, the difference being charged to laboratory overhead. What must they do? Construct electrical equipment for sixty-six high-speed signal-controlled self-leveling elevators. One battery of express cars will make no stops below the sixtieth story, and it will reach that height in less than one minute! The main shafts will not go above the eightieth story. A separate battery will serve floors above.

The Empire State's steel frame weighs in excess of 58,000 tons, the largest single order ever placed in building construction. Loads on individual columns also break all previous records. Several columns bear 10,000,000 pounds each.

Weight is one of the principal factors in skyscraper construction, and in this case the architects were driven to a new type of exterior construction. For the first time, they made extensive use of aluminum and chrome-nickel



Architect's Drawing of the Empire State Building, Which Will Be 1,250 Feet High to Tip of the Aviation Beacon



Riveters Are Here Shown at Work on the Mammoth Structure 900 Feet above Street Level; It Will Be 200 Feet Higher than the Eiffel Tower

steel in exterior facing. Below the steel window frames, cast aluminum spandrels, finished dull, are used, and between windows, polished fluting of rust-resisting chrome-nickel steel. White limestone covers the rest of the steel.

On exterior alone, the use of metal reduces the weight of walls fifty per cent. Thus it was possible to run the building up 1,250 feet without straining the steel skeleton or overloading the foundation. The Empire State could have gone much higher, but under the present economic balance, a height beyond 1,250 feet would have been unprofitable.

The architects devised still another innovation when they made the 6,400 windows integral parts of the wall. They are almost flush with the stone facing. This invention made it possible to simplify the stonework and reduce its cost. The ordinary stone-faced building has about one cubic foot of stone for each fifty cubic feet of building. The Empire State has one cubic foot of stone for every 200 cubic feet of building.

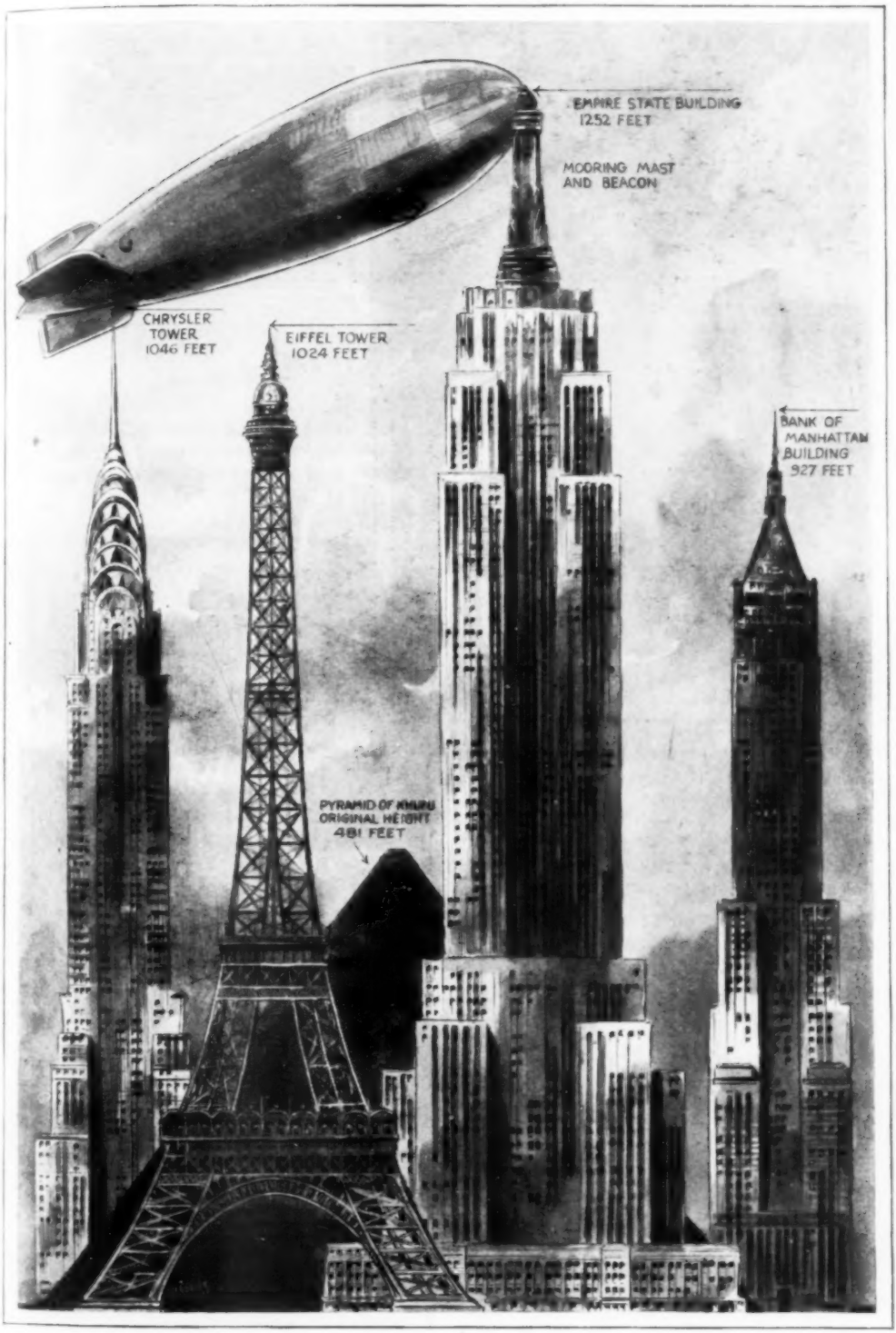
The use of metal, aside from the saving of weight, means an economy of space too. No radiator projects beyond the wall surface, and ventilating ducts are also concealed.

Whoever saw the construction of this superbuilding witnessed a miracle of organization, efficiency and precision. Enormous interest charges, insurance fees and tax assessments were in force, and the running costs of $10,000 a day made minutes the most indispensable items in the venture.

At the peak of construction, 5,000 men were employed on the job. In building-material plants all over the world, thousands of other men had to ship their products on time. Thousands of others were engaged in nothing more than transportation.

The arrival of 58,000 tons of steel, 10,000,000 bricks and 200,000 cubic feet of stone, besides daily deliveries of 5,000 bags of cement, 450 cubic yards of sand and 300 bags of lime, did not interfere with passenger or vehicle traffic around this building.

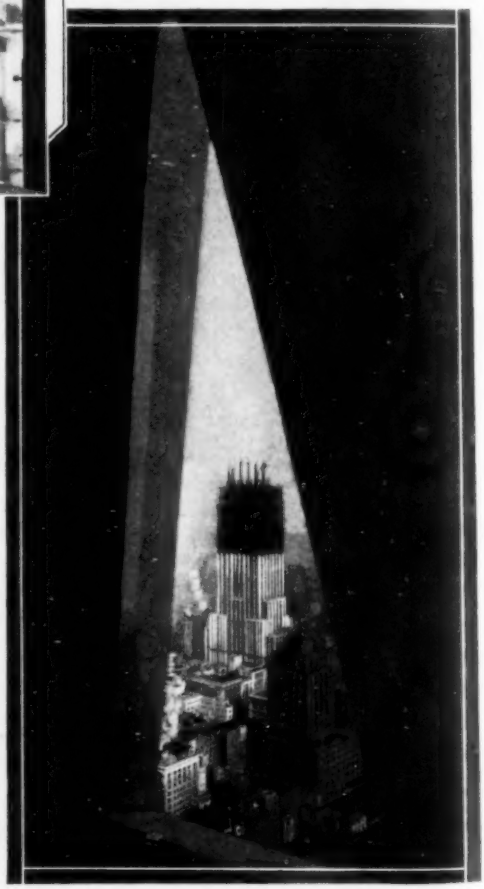
With so much material constantly arriving, it was necessary to dispatch trucks like trains. Three minutes might mean $100 to the contractor. Drivers learned their routes so well that they could snake their way through congested districts with a minimum of delay. A hundred trucks drove toward the building site at one time. Some were running under the Hudson river; others crossed from New Jersey on ferryboats, and still others came across



Drawing Showing Comparative Heights of the Empire State Building, Which Will Be the Tallest Man-Made Edifice, and Other Tall Structures of the World, Including the Pyramid of Khufu

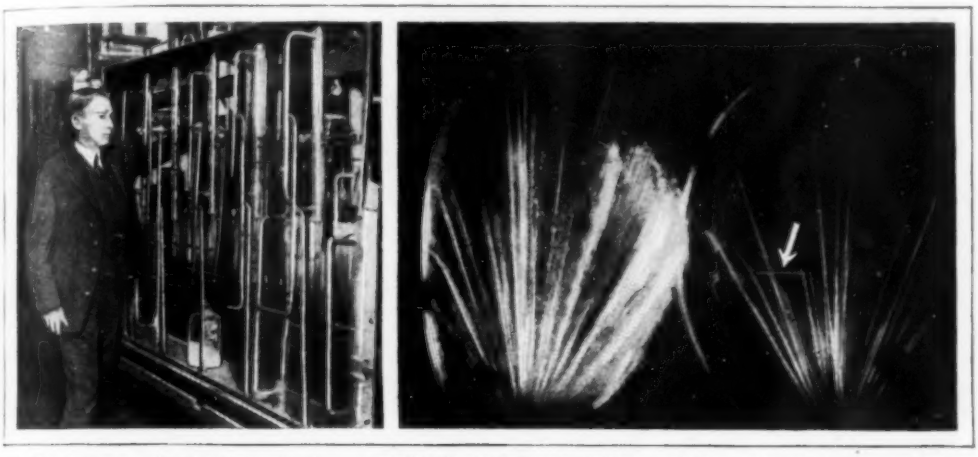
bridges. If they started too early, it was almost as bad as if they arrived too late, for the unloading space, of course, was rather limited.

The din of steam hammers, air hammers, riveting machines and hoists filled the air above, while trucks on the first floor discharged their loads of sheet iron, bales of wire, spools of cable and miles of brass water pipe. Then distribution commenced. The novelty of distributing bulky material by mine-railway system had never occurred to builders before. But here was no ordinary building, and when engineers calculated that the normal hoist carries only 1,500 pounds at eighty feet a minute, they were puzzled how to supply 290 bricklayers, 384 brick laborers and 225 carpenters with materials on upper floors. Their problem was to double not only the capacity but the speed of each hoist. Engineer detectives were sent west to the deep copper mines and there they saw lifts literally leaping out of the earth at fifteen miles an hour, carrying a dead load of 3,000 pounds! An express passenger elevator dives only four and a half miles per hour and gives a giddy sensation to riders. Mine hoists were introduced to Fifth avenue by the Empire State. The innovation saved many thousands of dollars in time and equipment. At a breakneck speed of 1,320 feet per minute, the hoists streaked up and down their shafts like phantoms, making no more noise than a modern passenger elevator. No man was allowed, nor would he dare, ride one, for the sensation would be similar to falling through space. At each floor a track-distribution system was installed. Materials in cars were stopped, rolled off, switched, and dumped—3,000 pounds per shipment.



Above, Riding the "Ball," Below, Unfinished Structure Seen from Modernistic Window of Chrysler Tower

THIRTY-SEVEN-THOUSAND-MILE A SECOND BULLETS



Left, Apparatus Which Fires Hydrogen "Bullets" at Atoms in Effort to Release Atomic Energy; Right, Arrow Points to Hydrogen Nucleus Traveling 10,000 Miles a Second

Science is now bombarding the atom with a "machine gun" firing hydrogen "bullets" at a speed of 37,000 miles a second in an effort to break up this elemental unit of all matter and release the potential energy it possesses, which some estimate as sufficient to do the work of all the world. The National Academy of Sciences in New York is sponsoring a machine with which the almost infinitesimal atom is being attacked. This formidable piece of apparatus shoots hydrogen atoms at the atoms of other elements in efforts to break up the latter and solve a problem that has long intrigued science. Pictures have been obtained of one of these hydrogen "bullets" when the nucleus was traveling at the rate of 10,000 miles a second, or more than half a million miles a minute.

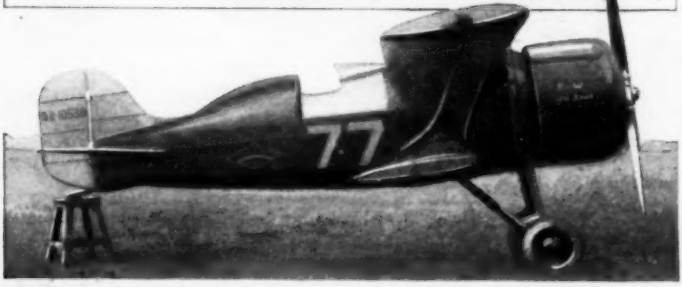
DESERT SANDSTORM DETECTOR

Quite by chance, three French scientists recently found a reliable means of warning tribesmen, troops and voyagers of the approach of sandstorms in the desert. The men had erected an instrument to observe the movements of flying insect hordes through the desert air, and through telephone apparatus connected with the instrument they heard one day a peculiar beating noise which was found to herald the rising of a sandstorm. The explorers then constructed an improved instrument, known as an "atmoradiograph," expressly to give warning of such storms.

TINY FIREBOAT USED TO FIGHT INACCESSIBLE BLAZES

Tiny fire tugs have joined the ranks of miniature golf courses and small automobiles. These little boats, hardly larger than a fair-sized rowboat, are being used in Boston to fight pier blazes which often are inaccessible to large craft.

Tiny Fireboat Which Has Been Found Highly Useful in Boston in Fighting Pier Blazes Which Often Are Almost Inaccessible



Above, an Old, and Below, the Latest Type of Speed Plane; the Little Ship Below Is Virtually All Engine and Weighs 1,400 Pounds

ENGINE FITTED WITH WINGS SEEKS SPEED MARK

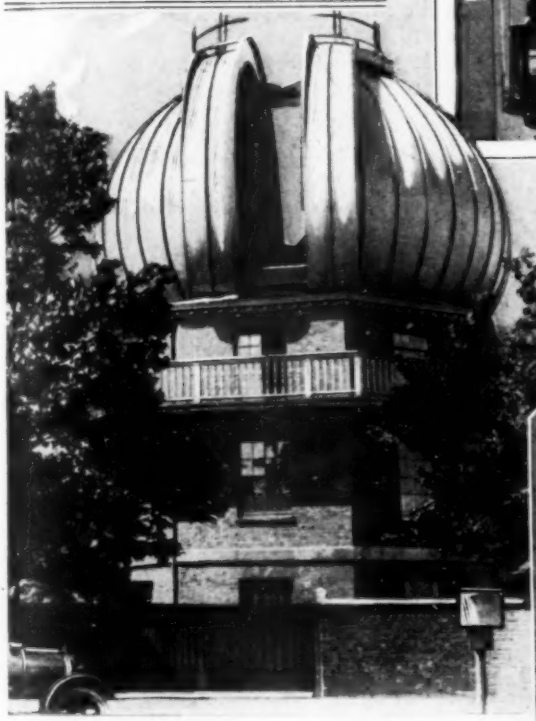
A 500-horsepower engine equipped with a pair of wings—that, in brief, describes a tiny airplane with which Lee Shoenhair, speed pilot, hopes to lessen the time required to move from one point to another. In tests, the little biplane, that is virtually all motor, averaged 201.91 miles an hour around a five-mile triangular course, but was unable to make the turns at full throttle. The plane was built around the engine, everything being kept to the minimum in size. It was designed primarily as a pylon racer, and can fly in a vertical bank around a closed course almost as easily as other ships negotiate level courses. Because of its size, only enough fuel for an hour's flight is normally carried. It has a wing spread of nineteen feet, and the cockpit is eighteen inches wide.

FADING OF COLORS DEPENDS ON DYE

Conditions which cause fading in colored fabrics are dependent on the type of dye used, and not on the color of the cloth. It has often been believed that yellow colors fade more easily than others, but experiments by the bureau of standards show this is not the case. The chemical type of the dye, and not its color, is the big factor in determining its ability to withstand fading from light or washing. While there is no such thing as an absolutely fast dye, dyes that retain their shades when subjected to the conditions for which they were intended, and for the time intended, may be considered fast. Fading is much affected by the humidity of the atmosphere, and dyes exposed to the sunlight in California and Arizona do not fade as quickly as when placed under similar conditions in the east. There is no relationship between the fading of a dye in sunlight and fading when laundered. A few withstand both tests, but a great majority do not fade under one condition although they do in the other. In the bureau of standards tests, a washing machine is used which tests twenty samples of dyed cloth at a time, and other samples are exposed to artificial light simulating sunlight in its effects.

WHERE THE EARTH'S SURFACE BEGINS—AND ENDS

Upper Left, Tablet at Greenwich, England, Marking "Longitude 0"; from This Imaginary Line, the Rest of the Globe Is Marked into Units; Above, Telescope Facing Due South and Alined with Greenwich Meridian; by the Passing of Stars across a Thread in the Eyepiece, Greenwich Mean Time Is Computed



Above, Observatory at Greenwich, England, Containing a Great Telescope Which Is Part of the Elaborate Equipment Used by Scientists to Tell the Time of the World; Greenwich Meridian, Designated as "Longitude 0," Is the Official Starting Point of the Earth's Surface; from It Meridians Differing by Fifteen Degrees Each Have Been Marked Off on the Globe, East and West; Right, Standard Sidereal Clock at Greenwich Which Never Varies More than One-Fiftieth of a Second; It Is Kept in a Sealed Glass Case at an Even Temperature of Sixty Degrees

CHURCH LIKE GIANT PIPE ORGAN IN DANISH CAPITAL

An Example of Modern Architecture Is This Copenhagen Church Resembling a Huge Pipe Organ

Towering at the end of a street in Copenhagen is a massive church built after the modernistic trend of architecture to resemble a huge pipe organ. It stands at the end of a street lined with brick houses which add to the illusion of a great outdoor organ with the front wall of the church forming the pipes. It is named the Grundtvig church.

CLOTHES ABSORB SOUND

Audiences in a theater or talking-picture house absorb more sound in winter than in summer, due to the increase in clothing in the colder season. For this reason actors must speak louder to winter audiences, and the loud-speaking talking-picture equipment must be tuned to higher volume in winter. The quality of clothing worn by an audience, experts of the bureau of standards have found, is a large factor in determining the length of time required for sounds to fade away. Experiments also have shown that theaters equipped with soft velvet-covered spring seats require more volume because the seats absorb sound to a high degree.

"SILENT" PIANO IS AUDIBLE ONLY TO THE PLAYER

Using tuning forks as substitutes for the usual strings, an eastern inventor has patented a piano which can be made audible only to the player and instructor, or turned on for others at will. This is accomplished through a series of audio cells and a set of earphones. The sound can be confined to the phones if desired so that neighbors need not be disturbed by practicing or playing at late hours. Another advantage claimed for the instrument is that it does not have to be tuned, as the forks hold their pitch and the piano can also be made smaller and lighter, the tuning forks needing less support than the strings in the usual instrument.

FARM-WASTE CHOPPER HELPS IMPROVE THE SOIL

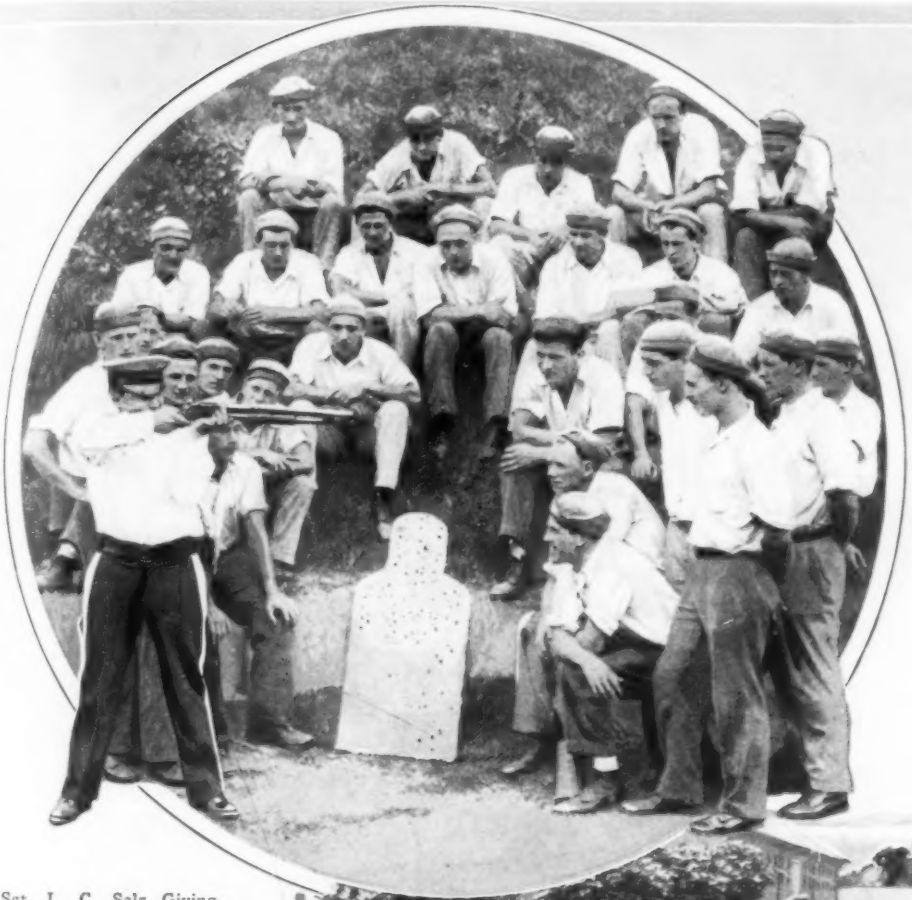
To reduce bulky waste, after harvesting crops, to a fine mulch for the improvement of the soil, a chopper operated by a tractor has been introduced. Spinning steel disks cut the refuse into shreds so that it can be more easily plowed under and mixed to nourish the soil. The attachment illustrated here is being used to cut up pineapple stumps on a large plantation.

Disk Chopper Run by Tractor Which Cuts Up Farm Waste so It Can Be Plowed Under to Nourish the Soil

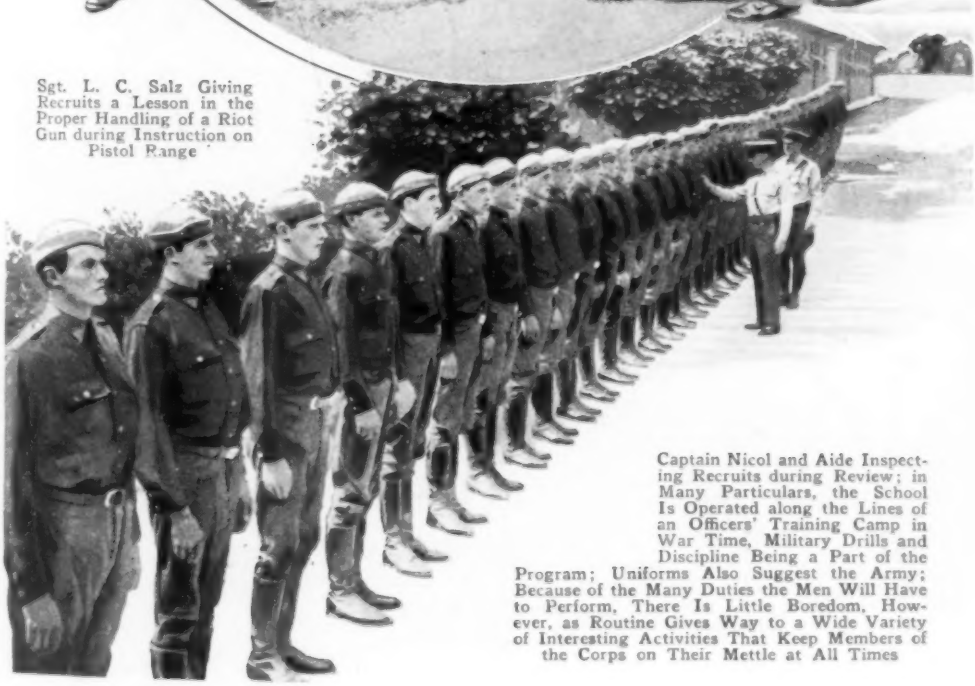
They Get Their Man

These and the Following Are Glimpses of the New Jersey State Police Training School at Trenton; Pyramid Horseback Riding and Driving Motorcycles through Narrow Space at High Speed

Above, Giving Instruction in the Proper Method of Taking Fingerprints and Identifying Them; State Police, Co-operating with Other Bodies, Must Be as Well Versed as Any Arm of the Law if Efficient Results Are to Be Obtained; at Right, Capt. William Nicol, Commanding Officer of the Training School; He Was Awarded the Distinguished Service Cross, the Croix de Guerre and the Distinguished Service Medal of the State of New Jersey for His Actions in the World War; Below, Limbering-Up Exercises of a Mounted Group; the Horses Are Almost as Well Trained as the Men and Seem to Enjoy Their Training and Service Duties; the Corps Is Made Up of a Select Group of Men Chosen on the Basis of Rigorous Physical and Other Examinations, and, Before They Go on Actual Patrol Duty, the Men Serve Three Months under Intensive Training to Fit Them Physically and Mentally for the Work Ahead

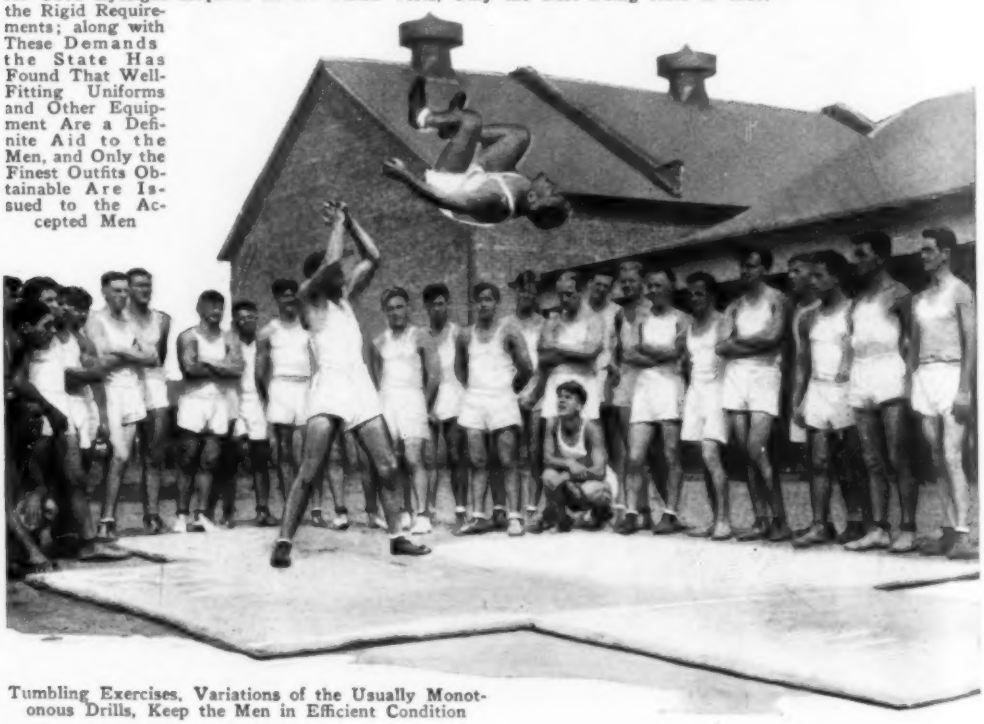


Sgt. L. C. Salz Giving Recruits a Lesson in the Proper Handling of a Riot Gun during Instruction on Pistol Range

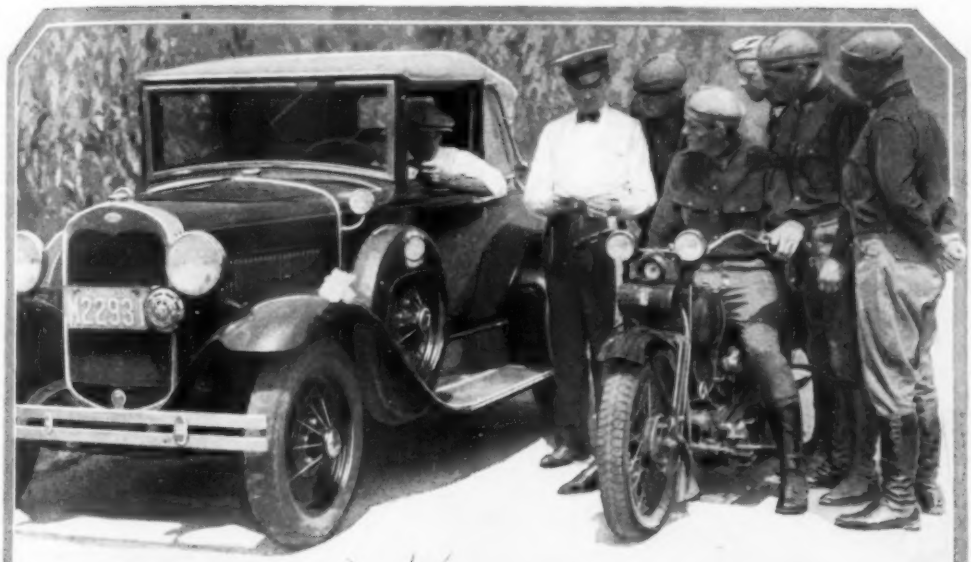


Captain Nicol and Aide Inspecting Recruits during Review; in Many Particulars, the School Is Operated along the Lines of an Officers' Training Camp in War Time, Military Drills and Discipline Being a Part of the Program; Uniforms Also Suggest the Army; Because of the Many Duties the Men Will Have to Perform, There Is Little Boredom, However, as Routine Gives Way to a Wide Variety of Interesting Activities That Keep Members of the Corps on Their Mettle at All Times

Candidate for the School Arriving at Headquarters; Leaving the Storeroom with an Outfit of Clothing, a Scene Recalling Army Days, and Ready for Motorcycle Duty; There Are Plenty of Hazards in an Ordinary Policeman's Work; a State Highway Officer, Patrolling a Wide Area with a Motorcycle, Is Subjected to Unusual Dangers; He Is Therefore Taught to Be an Expert Rider and Motorcycle Mechanic; Special Need for Good Eyesight Requires Severe Vision Tests, Only the Best Being Able to Meet the Rigid Requirements; along with These Demands the State Has Found That Well-Fitting Uniforms and Other Equipment Are a Definite Aid to the Men, and Only the Finest Outfits Obtainable Are Issued to the Accepted Men



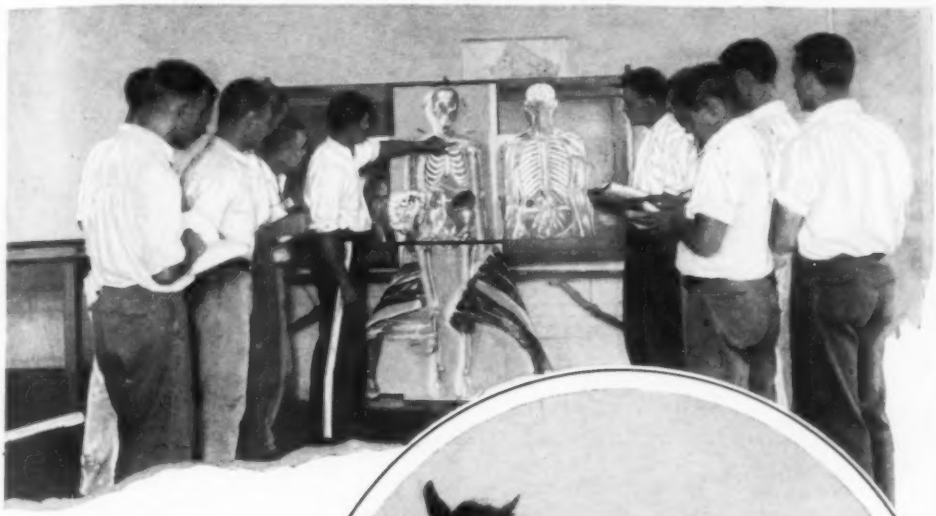
Tumbling Exercises, Variations of the Usually Monotonous Drills, Keep the Men in Efficient Condition



Sgt. J. H. Kierman Demonstrating to Recruits the Proper Methods of Questioning and Examining an Autoist, Overtaken on the Road; Tact Is Sometimes More Effective than Force, and State Police Are Instructed How to Use Both; More Variation for the Physical Drill, a Lesson in Fencing Develops Strong Arms and Keen Vision as Well as Endurance and Nimble Feet

Sgt. J. H. Westphalen Teaching the Prone Pressure Method of Artificial Respiration, an Effective Way to Revive Persons Apparently Drowned or Overcome by Lightning and Other Shocks; the Highway Police Are Trained to Be Experts in the Most Efficient Methods of First Aid in Accidents of All Kinds; at Left, While There Are Many Forms of Exercise, All Valuable for Improving the Physical Condition, Few Have Been Found Better for the Hardy than Boxing

Sergeant Salz Instructing a Class in Pistol Practice; of Late Years, More Attention Has Been Devoted to This Branch of Training than Ever Before; Scientists Have Studied the Needs of the Police Departments and Have Produced Special Targets, Moving and Stationary, That Help Develop a Steady Arm, an Accurate Eye and Quickness on the "Draw"



Further Instruction in First Aid; Teaching Recruits the Skeleton Structure of the Human Body so That They Will Be Better Able to Identify Broken Bones and Aid Accident or Other Victims; in Circle, Veterinary Work; Just as the Motorcycle Men Must Be Able to Take Care of Their Machines, so Must the Mounted Men Be Able to Tend Their Horses

Returning from a Five-Mile Run; Formation Exercise on the "Double" Is Always a Test of the Well-Drilled Unit; Note the West-Point-Like Precision of These Arm and Leg Movements and the Slight Variations in the Carriage of the Heads; Few Groups of Men Would Appear As Orderly as This One after Finishing a Run of Five Miles

Motorcycle Men Learn to Take Their Machines Apart and Put Them Together Again without Having Anything Left Over; Emergency Repairs and Immediate Diagnosis of Trouble Are Essentia Many Times, Hence the Emphasis on This Part of the Training; in Circle First-Aid Practice on the Road in a Simulated Automobile Accident, and, Below, "Column Left"; Army-Drill Methods Have Been Found Superior in Teaching Quickness and Obedience to Orders and a Sense of Co-operation with the Other Fellow, Two Essentials to a Well-Trained and Efficient Body of Men

Sergeant Westphalen Teaching Another Interesting and Important Subject, the Art of Jiujitsu, so That the Policemen Will Be Able to Handle Their Man After They Catch Him; at Right, a Product of Three Months' Training, a State Highway Policeman in Full Uniform, Erect and Ready for Duty, Trained in a Wide Variety of Duties and Sufficiently Experienced to Meet the Situation with a Good Background of Physical Preparedness and Keen Mental Abilities; Below, a Moment of Relaxation; Recruits Have Their Own Miniature Golf Course and Find the Exercise a Welcome Relief to Mind and Muscles after the More Rigorous Work of the Day; after the Three Months of Intensive Training, Exercises and Drills Are Continued, but More Moderately, to Keep the Members of the Department in Good Physical and Mental Trim at All Times

AUTO CONVERTED INTO YACHT BY LOWERING PONTOONS

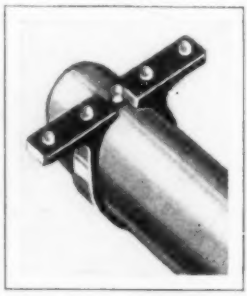
Above, a Seagoing Auto with Pontoons Being Lowered; Right, the Auto Transformed into a Yacht

Pontoons, which are lowered into position by pressing a lever, convert an automobile of unconventional appearance into a yacht that bears little resemblance to the ordinary boat. When used as an auto, it runs on three wheels, and in the water on pontoons.

TRAIN AND STEAMER WHISTLES HAVE OWN LANGUAGE

Train and boat whistles speak an interesting language to the person who understands them. A steamer approaching another from behind and desiring to pass to starboard, sounds one blast of its whistle. The ship to be passed will reply with a single blast, signifying the signal has been understood. If the overtaking boat desires to pass to port, it gives two blasts which are answered by two. Similar signals are blown by approaching ships when so close that there is danger of misunderstanding. Three short blasts of a boat's whistle indicate that the engines are running full speed astern. One long blast is given on leaving a pier and on inland waters when approaching a bend in the river. In fogs, long blasts of four to six seconds' duration, at intervals of not more than a minute, are blown. A distress signal is given by four or more short blasts, but it does not necessarily mean a catastrophe. It may be a warning to other vessels that the ship is not in a position to maneuver, or may signify a minor mishap that temporarily has disabled the vessel. Gongs or sirens indicate fire at sea. The whistle is not used. The single train whistle is blown before a stop, a relic of old days when brakes were applied by hand and the single blast gave the command to the brakeman. Two blasts indicate starting, three to back. One long and three short blasts at night when the train is stopped order the flagman to leave the train and go back with flares, lantern and torpedo. Five long blasts tell him the train is going to start again.

GUN SIGHT FOR BIRDS IN FLIGHT INSURES CORRECT AIM



Duck hunters, accustomed to the trial-by-error method of judging the proper "lead" to be given when aiming at a bird in flight, now have this difficult problem solved for them with a sight which can be mounted on any type of gun barrel. The fixture clamps around the end of the barrel and contains two brass beads on a horizontal frame extending to right and left of

the regular gun sight. These extra sights enable the hunter to establish automatically the distance he should fire in front of his moving target to score a hit. The sight is easily removed when not needed.

BALDNESS CAUSED BY ARSENIC AND LEAD IS CURABLE

Growing use of arsenic and lead in modern civilization is responsible for an increasing type of baldness for which a remedy has been found recently by chemists. Arsenic is used in spraying fruits and vegetables and is found in foods, drugs and beverages, while lead is found in spray residues, in drinking water and in the air. Baldness caused by these agencies is confined to a sharply circumscribed area from which the hair falls quickly, sometimes in a few hours and quite often in a few days. Chemists have found a successful treatment for this particular form of scalp ailment which tests have shown to be highly satisfactory.

AUTOMATIC TIMER AIDS KICKER IN FOOTBALL PRACTICE

To aid the kicker in getting the ball away within the specified time limits, an automatic football timer was used with success in training the Harvard squad. The ball, held by the passer, rests on a horizontal arm of the device, known as a "coachamatic." When the ball is snapped the arm goes up, releasing a mechanism which rings a bell two seconds later. The

Football Timer Which Rings a Bell Two Seconds After the Ball Has Been Snapped by Passer

backfield man is expected to have the ball before the bell rings.

FIFTEEN TONS OF HORSESHOES COLLECTED BY BLACKSMITH

Fifteen Tons of Old Horseshoes Collected by a Village Blacksmith in the Past Twelve Years

Twelve years ago the village blacksmith of Hopkinton, N. H., began piling up discarded horseshoes outside his shop and the stack has been growing ever since. Today he estimates he has fifteen tons of old shoes in the collection, which is about ten feet high, all of them removed from the feet of his equine customers with his own hands.

ELECTRIC LIGHT IN BALLOON TELLS WIND DIRECTION

For night weather observations, a California man has devised a wind-direction indicator consisting of a small balloon which carries a parachute with two dry cells and a small bulb attached. When the balloon reaches too high an altitude or bursts for any other reason, the parachute allows the cells and lamp to float to the ground without injury to any persons or damage to property. The device is also considered safer, because it cannot start forest fires as is sometimes the case when flares or candles are employed.

Model of an Airplane Propelled by Rockets, Some of Which Furnish the Driving Power and the Rest Act as Stabilizers

PLANE PROPELLED BY ROCKETS AT TEN MILES A MINUTE

Airplanes propelled by rockets are being planned after tests with a flying model of a two-passenger ship using rockets for power. The model, built to withstand speeds up to 650 miles an hour, or more than ten miles a minute, is all-metal in construction and is powered with thirty-eight steel-cylinder rockets, ten furnishing the driving power and the rest supplying stabilizing and balancing action. It is estimated that more than twenty horsepower can be developed by the model, which is expected to soar to a height of six miles at record-breaking speed and then glide to the ground.

MICROBES FOUND IN COAL

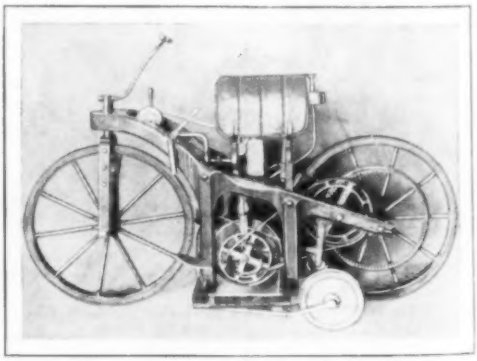
Living, brilliant-hued bacteria have been found in coal that is millions of years old, and appear to have lived there ever since the coal was formed. Great microscopic magnification is necessary to see the coal bugs, which are frequently egg-shaped, but may be quite elongated, some of the latter being brilliantly iridescent. Given a chance to reproduce in a cultivating medium, the microbes grew to millions in a few hours. Bacteria also have been found in specimens of pre-Cambrian rocks, usually estimated to have been formed over 200,000,000 years ago.

IVY POISONING IS RELIEVED BY NEW DRUG

Poisoning from poison ivy or poison oak is now being treated by neutralizing the active element of this unpleasant plant. Toxicodendrol, the irritating agent, can be made non-poisonous by changing its chemical composition so that the proportion of oxygen is increased, and this is accomplished by benzoyl peroxide, a non-irritating, non-poisonous substance. When benzoyl-peroxide powder is dusted over the affected area, and kept in place by a light bandage, the itching disappears in about twenty minutes and does not return for several hours after a single application. It is not a certain cure in all cases, but it does relieve the itching and prevents further spread of the poison.

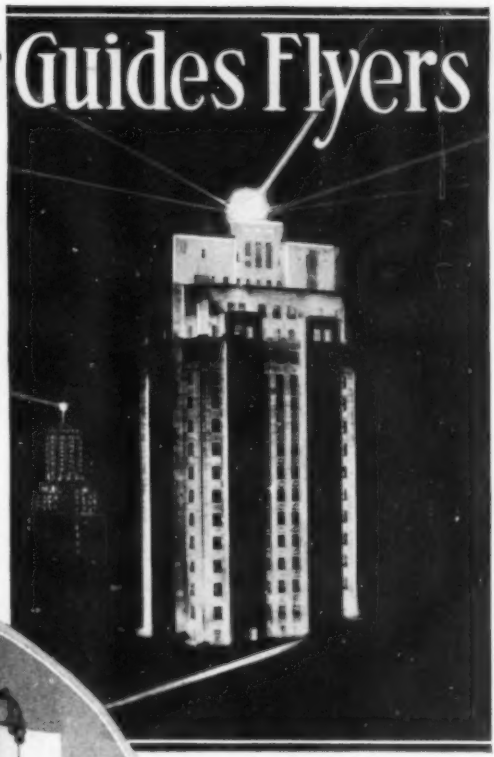
ONE OF WORLD'S FIRST AUTOS FINDS PLACE IN MUSEUM

One of the world's first automobiles, a German car built in 1888 by Karl Benz, has been obtained by Henry Ford for his museum. Mr. Ford purchased the early ancestor of the modern car after examining an even earlier model, a machine that was built in 1885, which is now displayed in a Munich museum.



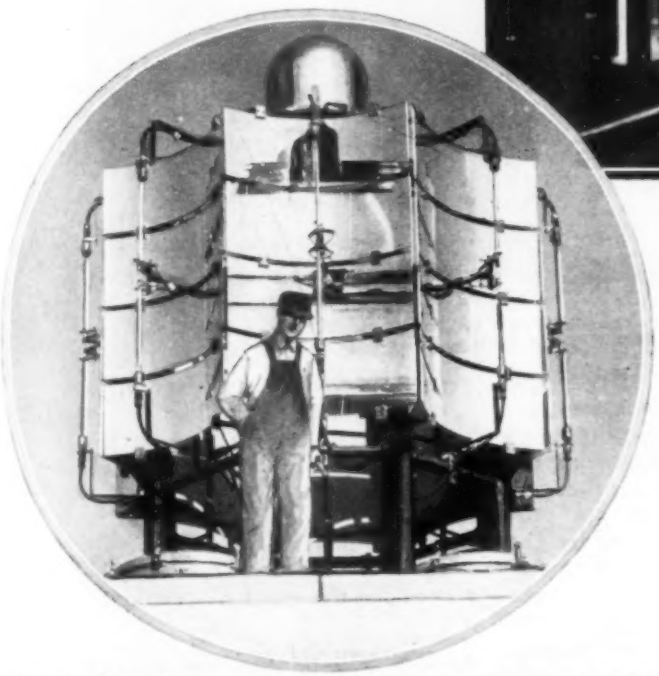
An 1888-Model Auto Built by Karl Benz and Recently Purchased by Henry Ford for His Museum

Man-Made Star Guides Flyers



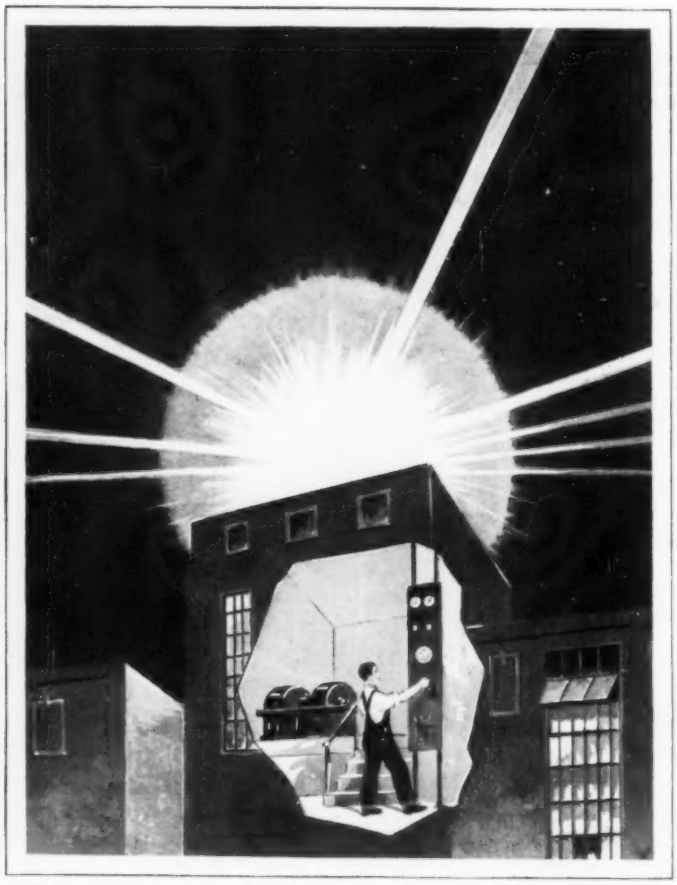
CIVILIZATION is constantly reaching back into the centuries for old ideas to meet modern needs. An outstanding example is the sun-flash aircraft beacon on top of the LaSalle-Wacker building, one of Chicago's newest skyscrapers. It incorporates an idea employed by engineers of ancient times in constructing the Pharos or primitive lighthouse that marked the entrance to the harbor of Alexandria, Egypt.

The early builders adjusted sheets of polished metal to reflect the rays of the sun and to send the gleam of the burning torches in the lighthouses far to sea at night. In the same way, A. N. Rebori, architect and designer, has used parabolic mirrors to intensify and reflect the rays of the sun and of neon-gas tubes at night. While the beacon does not compare in candlepower with some of the huge searchlights used for guiding aircraft, its efficiency has been amazing. Recently, an aviator, leaving Toledo, Ohio, at dark, saw a peculiar orange-red gleam from an altitude of slightly more than 5,000 feet. He followed it all the way to Chicago and discovered its source atop the LaSalle-Wacker building. The distance was approximately 285 miles.



Above, the Sun-Flash Beacon at Night; Below, Some of the Parabolic Mirrors Which Reflect Sunshine by Day and Neon Lights at Night

This sun-flash beacon is fixed and has eight sides, corresponding to the main points of the compass. On each side is a curved mirror, five feet high and so adjusted that it intensifies the light some thirty times. Neon-gas tubes are installed in front of each mirror so that the effect at night is an illuminated compass that serves not only as a beacon but as a warning light to keep pilots from flying too close to the building.



Drawing Showing How a Small Motor Supplies Power for the Big Light, Which Can Be Operated for About Fifteen Cents an Hour

Between the eight beams of red light that have a vertical arc of 180 degrees, are white rays from eight searchlights of 8,000,000 candlepower each, producing the effect of an illuminated crown for the lofty skyscraper. These white rays are projected at about fifteen degrees above the horizon, while the red light is distinctly visible from directly above, an advantage over the usual single searchlight of the revolving type, which often cannot be seen by an aviator flying high above it.

Power for the beacon is provided by a twenty-five horsepower motor, driving a fifteen-kilowatt generator on the forty-first floor of the building. Performance to date indicates that the light can be operated for as little as fifteen cents an hour for current, and it is not costly to service as it needs little attention, once the mirrors and tubes are properly adjusted and focused. The apparatus is so constructed that the lights can be made to appear as revolving. This is accomplished by a rotary switch.

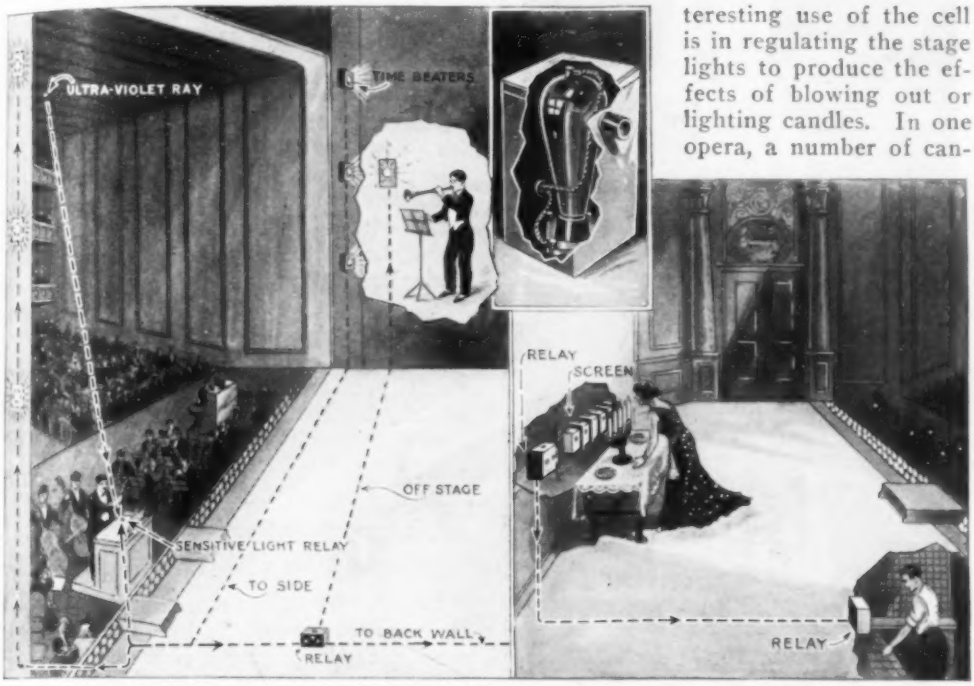
Aviators and others are familiar with the reflective power of glass, and flyers especially attest the need of beacons during the day as well as by night. It is proposed to install smaller beacons of the sun-flasher type along air routes. Even on cloudy days, they would reflect and intensify the light, making the markers visible at great distances, so that a pilot, unfamiliar with the way, would have less difficulty in keeping his course.

Set on dangerous mountain tops and other hazardous places, the beacons would serve the double purpose of guides and warning lights. Extensive tests have shown that the peculiar orange-red cast of the neon-gas tubes is one of the most effective colors in penetrating fogs and mists, and the added intensity of the light as sent from the sun-flash beacon, due to the mirror idea, makes it doubly efficient. Mr. Rebori and the General Electric company are making further experiments with the beacon to increase its effectiveness and to develop a type that can be widely employed for the good of aviation.

ALTERATION OF CHECK SHOWN BY ULTRAVIOLET LIGHT

Check paper treated with æsculin, a white powder obtained from the bark of the horse-chestnut tree, enables a bank teller to detect with ease erasures and changes in checks written on such paper. Aesculin is fluorescent, or glows, when placed under ultraviolet light, and an erasure shows up as a dark spot.

MAGIC "EYE" FOR OPERA AIDS LIGHTING EFFECTS

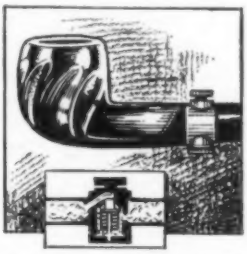


Artist's Drawing Showing Use of the Photo-Electric Cell on the Stage of the Chicago Civic Opera Company; the Unit Helps the Conductor Beat Time for Off-Stage Groups and Operates Lights

Two difficult stage problems, accurate regulation of lighting intensity and beating time for orchestras or musicians behind the scenes, have been solved by engineers of the Chicago Civic Opera company and of the General Electric company, with the aid of the photo-electric cell. In many of the productions, music off stage is an essential part of the performance and there is usually some difficulty in keeping exact time with the orchestra in front. The tempo formerly was picked up by some one standing concealed in the wings and relayed back, or the conductor tapped the time on a lighting indicator. Neither of these methods proved wholly satisfactory and a better way has been found with the photo-electric unit. It is installed in the conductor's desk in such a position that, as he swings his baton, his arm will pass over it and will intercept a beam of invisible ultraviolet light, shining from the ceiling. These interruptions, in a cadence that gives the exact time of the music, breaking the ray of light, causes the cell, in turn, to operate time beaters backstage. Another interesting use of the cell is in regulating the stage lights to produce the effects of blowing out or lighting candles. In one opera, a number of candles are extinguished. There is a hidden cell behind each one which operates a number of stage lights. As the candles are extinguished or lighted the cells affect the stage lights to produce realistic changes of the illumination.

VALVE IN STEM OF PIPE TRAPS MOISTURE AND ENDS "BITE"

Ending the "bite" and providing a cooler smoke, a pipe now is provided with a trap in the form of a valve in the stem held in an upright position by a spring.



When the smoker is drawing, the valve opens to pass the smoke, but when he stops, the valve shuts, effectively blocking the bowl from the stem and keeping out all moisture. It is impossible to blow through the pipe which remains dry and odorless. The trap is easily removed for cleaning.

Highway Sign Resembling a Man, Which Warns of a Bad Corner and Gives Other Road Directions

WARNING SIGN ALSO GIVES ROAD DIRECTIONS

To catch the eye of the passing motorist, a roadway sign resembling a human form stands on the outskirts of Castine, Me. The marker warns of a dangerous corner, and also directs the way to various near-by points, and gives other helpful information.

ROBOT DIVER TO HELP SALVAGE SUNKEN TREASURE SHIPS

Attempts will be made soon with a robot diving apparatus to recover treasure estimated at $50,000,000 which has lain at the bottom of Navarino bay, Messenia, Greece, for more than 100 years. The wealth is contained in the ships of the Turkish-Egyptian fleet, sunk in 1827 by the Russian, English and French fleets. The flagship alone contained more than $1,000,000 in money and precious objects worth even more. The ships now lie in thirty-two fathoms of water, and previous salvage efforts have failed because divers have been unable to descend to that depth to work on wrecks. Now there has been made a diving suit in which, it is stated, a man can go down 250 fathoms and work for ten hours without ill effects. It resembles a robot figure having arms and legs three feet long, and is made of light alloy, containing much magnesium. The occupant can eat, drink, smoke, and even write with perfect freedom. He can also kneel, lie on his back or face downward, and rise without trouble. The "hands" are like the antennæ of the crab, and the diver can pick up coins or shackle an eye to a spring with them. The obstacle of great pressure has been overcome by placing between moving members of the joints a cushion of oil which is non-compressible and readily displaceable.

TALKING LETTER IS DICTATED TO COIN-IN-SLOT MACHINE

Letters that talk soon can be sent from street-corner recording booths, where the sender, on depositing a coin in a slot machine, can dictate his message on a phonograph disk. He then slips the disk in a container and drops it in a mail box. The recipient listens to the words of the sender by "playing" the record on a phonograph. Coin-in-the-slot recording booths for taking such messages now are being planned along the lines of the automatic-photograph galleries already established.

Slot-Machine Booth, Where a Letter Is Dictated on a Phonograph Record and Mailed

PLANE WITH VARIABLE WING MAKES FLYING SAFER

Variable-Wing Monoplane Which Depends on Compressed Air to Alter the Angle of Incidence of the Wings; Hydraulic Cylinders Which Lift the Wings Serve as Shock Absorbers in Landing

With fifteen feet of copper tubing and two valves as his chief aids, Waldo D. Waterman, famous pilot, has developed a variable-wing monoplane which promises interesting results in greater safety and efficiency in aviation. As demonstrated in repeated trials, the plane gains some eighteen miles an hour in top speed, has greater stability, rides more easily in bumpy air and can be landed more easily than the usual type. The wheels of the Waterman ship are rigidly attached to the wing and the compressed-air shock absorbers are in the wing struts. Each wing is hinged at an angle of approximately twenty-five degrees to the line of flight. At the start, the wing is horizontal, but in the air an amazing change takes place. The wing assumes a curved appearance, that is, the tips rise until there is a dihedral angle of fifteen degrees and a change of over five degrees in the angle of incidence. In a few moments, the wing may straighten out to its original horizontal shape, then curve again. Waterman accomplishes this chiefly by means of the valves and the copper tubing. Compressed air, taken from the engine starter, is led into the shock-absorbing units. When they are full of air, they hold the wing in a horizontal position. Simply by releasing the air, the pressure in the shock-absorbing cylinders is decreased, allowing the tips of the wing to come upward. This gives a low angle of attack for maximum efficiency at high speed. A turn of a valve again causes air to be pumped back into the shock absorbers and the wing is straightened out for a landing. The air-filled cylinders also help absorb shocks and bumps in the air, so that the plane has greater stability.

The Man Is Standing on a Huge Fog Siren of a Modern Lightship; the Horn Is Air-Operated and Is Set to Sound Automatically

HUGE FOG SIREN ON LIGHTSHIP OPERATED BY AIR

Rising almost to the top of its funnel, a huge fog siren with a cluster of four bell-shaped horns is part of the equipment of one of the most modern United States lightships, now stationed off Fire island near New York. The big horn is air-operated and can be set to sound at designated intervals, being controlled automatically.

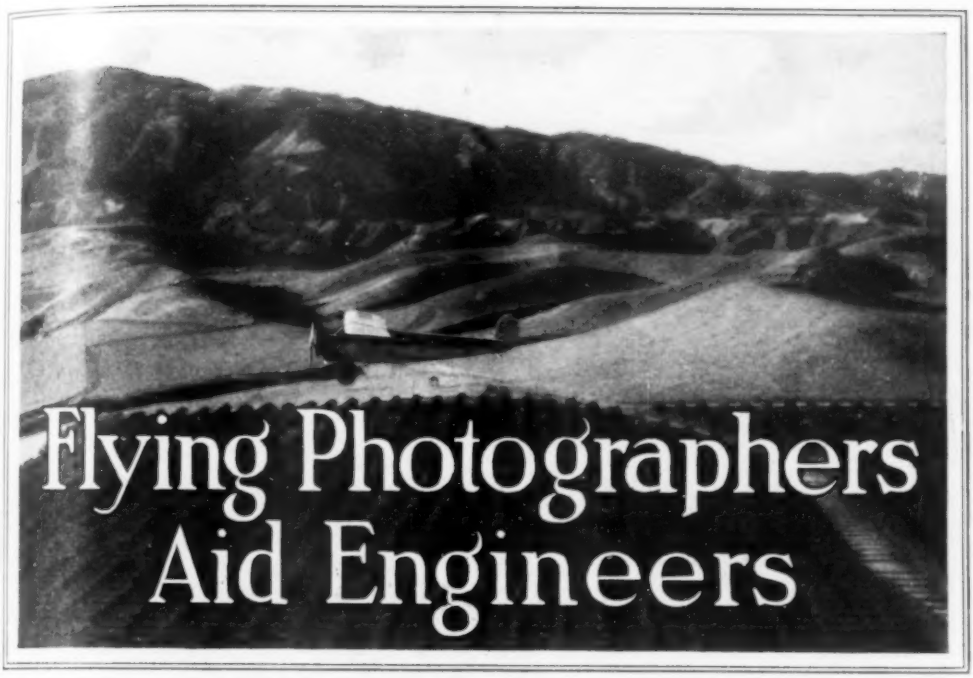
LONG-DISTANCE WEATHER SEEN IN POLAR TRIPS

Weather men will be able to predict rainfall and drouths months in advance as a result of polar explorations, especially in the Antarctic, according to Dr. Isaiah Bowman, of the American Geographical society. It is estimated that there is a shift of ten billion tons of air from hemisphere to hemisphere between the months of January and July each year, an amount equivalent to a mass of air thirty miles wide extending around the earth. The winds, scientists estimate, have a total energy of twenty billion horsepower-hours, and as their comings and goings are accurately predicted over areas where weather-observation stations are now established, an extension of the area under constant observation obviously would permit more accurate forecasts of winds and other conditions.

NEON CHANDELIER GIVES ALMOST WHITE LIGHT

Neon tubes, long used for electric-display purposes, now have been adapted to chandeliers for interior illumination. Neon tubes of different colors are combined in the chandelier to give a nearly white light which has been found to offer good illumination and also to be more restful to the eyes than ordinary lights.

Chandelier Composed of Neon Tubes in Different Colors, Which Combine to Give a White Light



Flying Photographers Aid Engineers

Aerial Mapping Plane in Flight above San Fernando Valley near Los Angeles; the Aerial Camera Is Placed in a Cradle Which Allows the Lens to Protrude through a Hole in the Floor

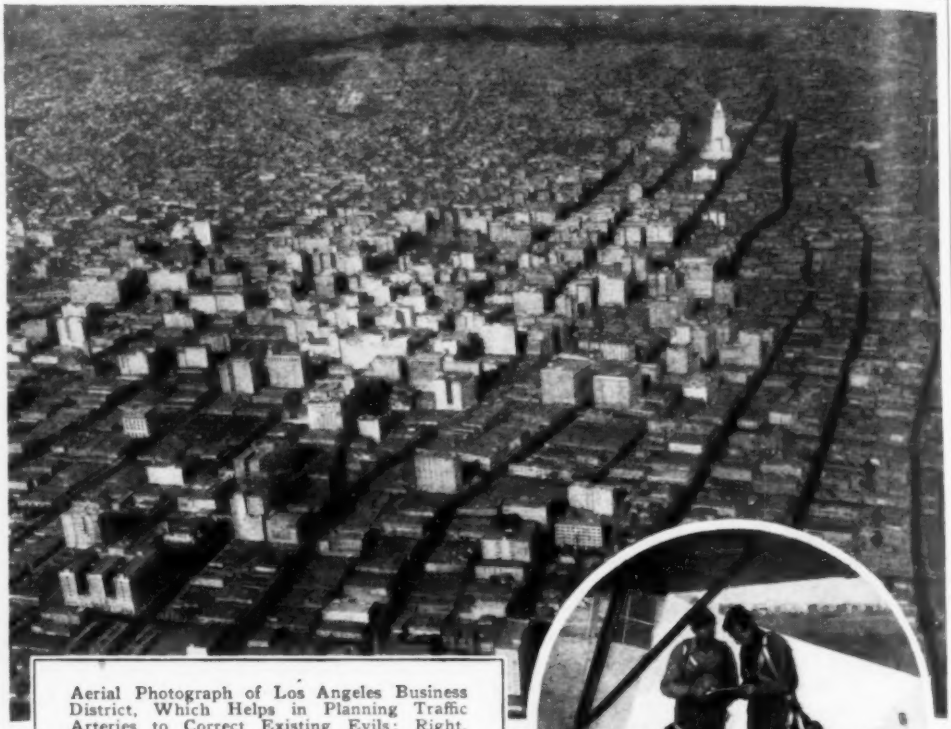
RECENTLY two American aviators hopped off from Esperanza, in southern Sonora, and nosed their ship toward the interior of Mexico. Flying about 140 miles directly inland, they reached the Yaqui river valley—a virgin territory of 100,000 acres of rich soil.

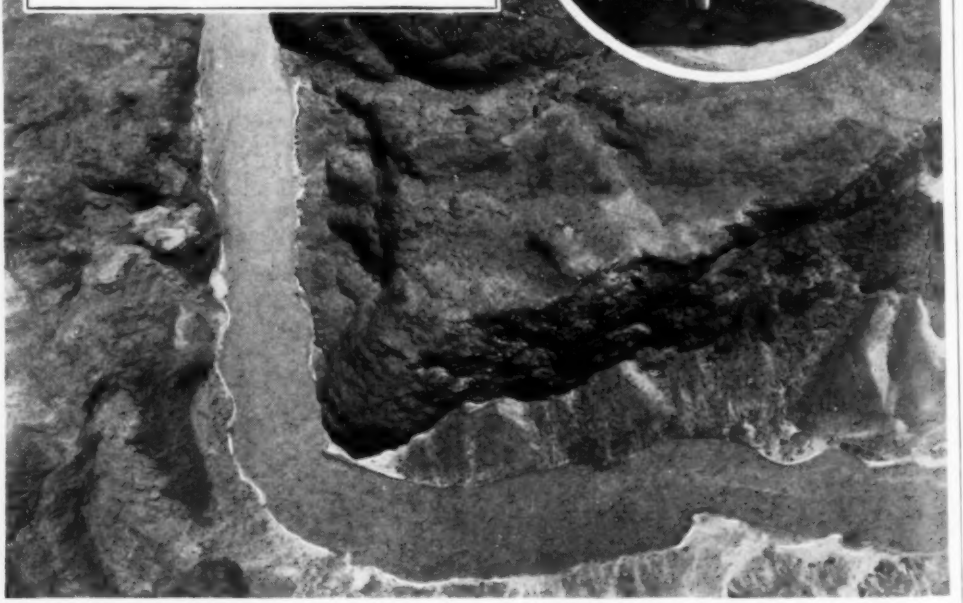
This region had long been watched by engineers, who realized the immense possibilities if a dam could be built to store the waters of the turbulent Yaqui. Several survey parties had attempted to explore the narrow canyon out of which the river emerges, but failed because of the inaccessibility of the place, and because of the warlike Yaqui Indians, who fiercely resent any intrusion by the white man.

The Americans carried with them a large aerial camera, mounted in a cradle, with a huge lens protruding through a hole in the floor. Back and forth across the valley they flew, describing a series of parallels and snapping photographs at regular intervals. Three and a half hours later, they were back in Esperanza. Technicians developed and printed the pictures and fitted them into a "mosaic," or composite photograph, of the entire region. Consulting engineers studied the maps thus compiled. The pictures of the valley answered many questions regarding the proper distribution of the water. They told what primitive irrigation had already been contrived by the Yaquis themselves—a question that had never been answered fully because of the hostility of the Indians. The pictures enabled the engineers to estimate the potential storage capacity and to narrow the choice of possible dam sites down to two.

Thus is aerial photography finding new applications daily in an infinite variety of industries. The engineer has forsaken his transit and chain and has taken to the air. He has found that a few hours' flight with a camera can tell him more than half a dozen crews of surveyors can learn in a month's work out in the field. The geologist has abandoned his pack outfit in favor of the speedy aeroplane. He has learned that he can study fault lines and general topographic features better from an altitude of 15,000 feet, than by laboriously trudging over the ground itself.

Among the first to discover the possibilities of the new science were the major oil companies. A geologist was glancing





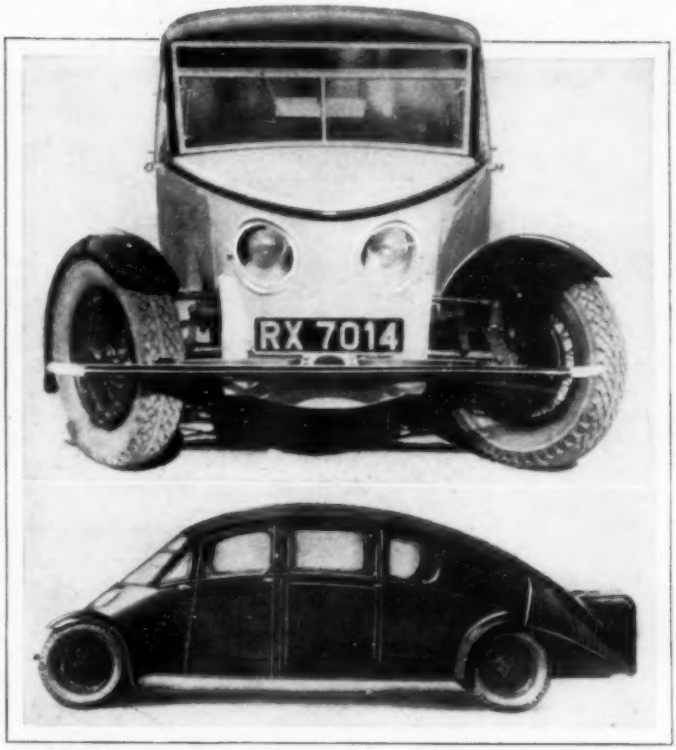
Aerial Photograph of Los Angeles Business District, Which Helps in Planning Traffic Arteries to Correct Existing Evils; Right, Photographer and His Pilot Planning the Route for an Aerial Mapping Expedition; Below, Aerial View of the Site of Hoover Dam; Government Engineers Are Aided in Their Work by Air Views of the Entire Region Affected

over air maps of a barren desert area, when he discovered certain markings indicating features he had never noticed on ordinary geological maps. He placed duplicate prints of the photo under a large reflecting apparatus that projected them in relief, like the old family stereoscope of parlor-album days. Given a third dimension by the stereoscope, the picture brought out clearly a fault line which indicated a characteristic oil-bearing structure. Successful drilling operations proved that the method was accurate.

Because it is swift, accurate and reliable, and, above all, because it is a means of helping big business to make ten dollars grow in the same time that one grew before, the fledgling industry of aerial photography has grown swiftly. Ten years ago it was merely a novelty developed during the war for reporting enemy troop movements and locating ammunition dumps.

Since then, its growth has been incredibly rapid. Companies specializing in the work have grown from one-man, one-ship outfits to complete organizations with large staffs and their own fleets of aeroplanes. An official of one of the largest commercial companies recently remarked that it would not be long until their files will include photos of the whole state of California. The same thing is rapidly becoming true all over North America. The daring flyers of the navy have mapped the wilds of Alaska.

Eventually you will be able to go into the office of a large aerial-mapping concern and get a photograph of any spot on the continent that you may designate. For Canada, the Philippines, Mexico, the remotest parts of the globe, all are yielding up their secrets under the eagle eye of the flying photographer.



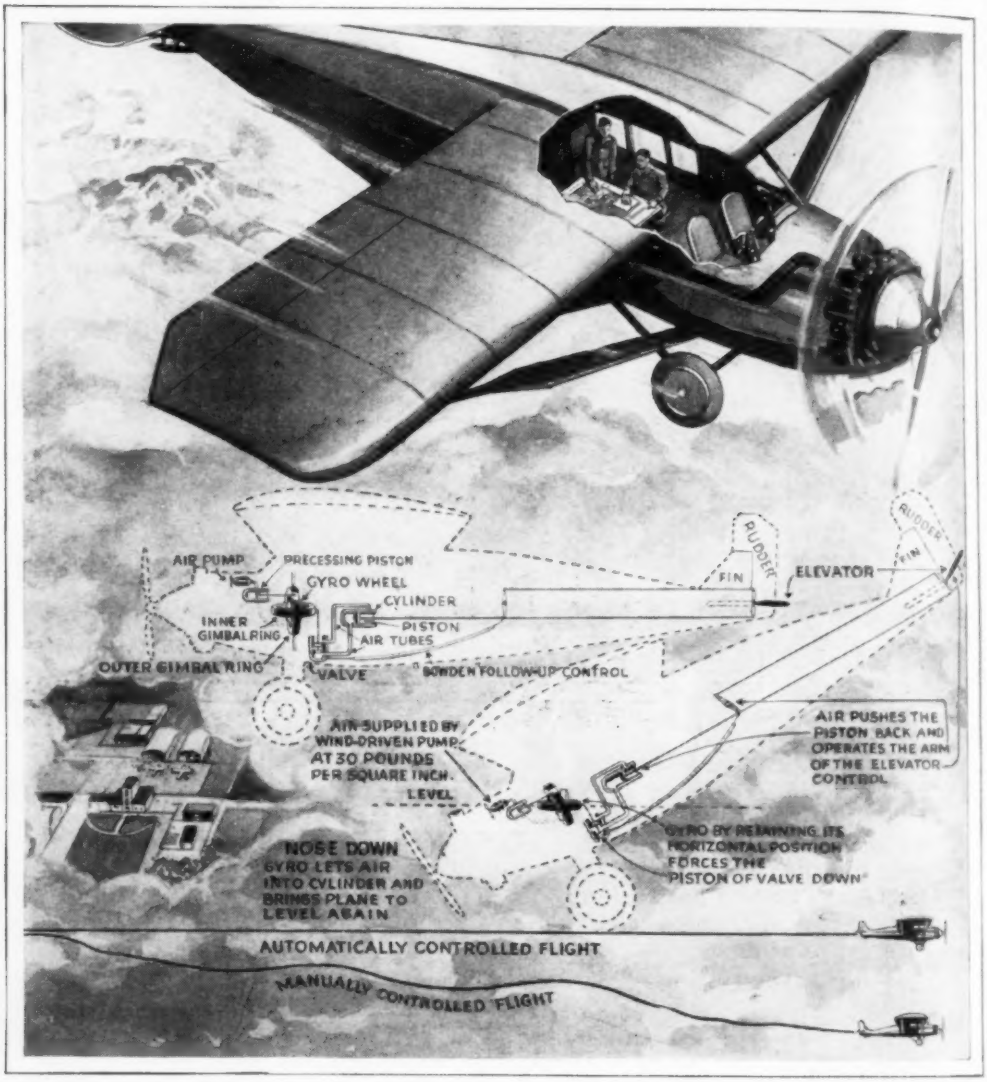
Streamlined Automobile Body Designed Like a Dirigible; the Unusual Shape Was Found to Effect a Fifty-per-Cent Fuel Saving

AIRCRAFT LINES ADD TO AUTO'S SPEED AND POWER

Streamlining similar to that employed in building the British dirigible "R-100" has been used by Sir Denistoun Burney, designer of the airship, in making an automobile body which reduces wind resistance to a minimum. The streamlining has been found to save fifty per cent in gas consumption, and about fifty per cent of the horsepower required to propel an ordinary car on a level road. The engine is built in the rear, and the spare wheels are carried in the doors. The front wheels have a fifty-degree lock, enabling sharp turns, and the lamps are recessed so that they form an unbroken curve with the body lines.

¶Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information will be furnished free by our Bureau of Information.

ROBOT AIR PILOT KEEPS PLANE ON TRUE COURSE



Courtesy The Graphic—(Drawing by S. Drigin)

Drawing Showing How a Robot Air Pilot Keeps a Plane in Level Flight without Human Interference; a Gyroscope Is the Robot's Brain, and It Works the Controls by Compressed Air

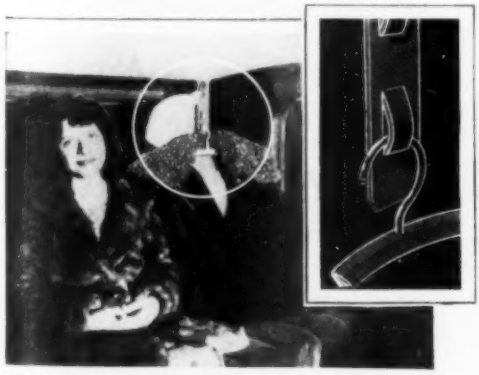
Successful tests have been concluded in England with a robot air pilot which automatically keeps an airplane flying in a straight course for hundreds of miles without assistance from any human agency. The apparatus, known as a pilots' assister, operates much more precisely than the most skilled human flyer and is expected to be invaluable in cross-country flights in fog and clouds. During tests, pilots set a course and then flew for more than 400 miles without touching the controls, being able to leave their seats and attend to other duties without so much as glancing at the many instruments which ordinarily must be watched constantly. The control depends for its sense of direction and level on a gyroscope driven by compressed air. Any deviation from level flight in a straight course causes the gyroscope to operate valves and pistons which, in turn, manipulate the controls.

TINTED GLASS AIDS IN MAKE-UP AND SAVES FACE

Used for some time in laboratories to help filter lights, a special glass has been adapted to the theater. Employed in the spotlight, it is said to diffuse a light that brings out the natural flesh tints so that the actors do not have to place so much reliance on make-up. The glass is known as "illusion pink" in the theater, and owes its color to two rare metals.

AUTO COAT HANGER KEEPS CLOTHES TIDY

Intended for the automobile, but equally handy in the home, is a coat hanger that is attached or detached in an instant. It consists of a strip of leather in which are cut two parallel slots through which the hook of the hanger passes and is held firmly in position. The leather strip contains a snap fastener which is attached to a screw stud placed in the woodwork wherever convenient. At the top of the strip is a metal spring clip that serves to hold hats, maps or papers.



Coat Hanger for the Auto Fastened to a Leather Strap Which Is Attached in an Instant

Twelve-Inch Mortar Railway Gun Which Can Fire a Projectile Nine Miles; It Is Intended for the Defense of the Atlantic Coast

MORTAR RAILWAY GUN TO AID IN DEFENDING COAST

Intended to attack invading battleships along the Atlantic coast, a twelve-inch mortar railway gun recently underwent successful tests. The weapon, which offers the advantage of speedy portability, fires a missile which travels to a height of about 1,700 feet, and has a range of from one to nine miles.

ALL AUTO DOORS LOCK AT ONCE BY PRESSING BUTTON

By pressing a button, all the doors of the automobile can be locked at once with a special locking assembly now available. The doors also may all be locked simultaneously by turning a key in the right front door. Although all the doors are locked from the outside, any or all may be opened from the inside as usual. The locking is done electromagnetically.

Small Portable Electric Vibrator Which Contains No Motor but Operates from Lighting Circuit

PORTABLE ELECTRIC VIBRATOR RUN FROM LIGHT PLUG

Giving a fast rate of vibration without the violent shaking produced by oscillation, a portable electric machine, so small that it can easily be carried in a small traveling bag, is now available. It is without a motor and operates from the electric-light circuit, consisting of a heavy coil surrounded by laminations. These act as a magnetic unit, creating the flow of vibrations through spring steel to which are riveted iron arms for attaching the belt for body or the head cap for neck-and-scalp massage. It has no moving parts or gears to get out of order, requires no oil or adjusting and offers a flow of 6,000 vibrations a minute on a fifty-cycle current, using no more electricity than is needed to light a sixty-watt lamp. When more tension is applied to the body belt, the vibrations increase in strength, but do not exceed the limit beyond which they might be unsafe.

¶Motorists paid $431,636,464 in gasoline taxes in 1929.

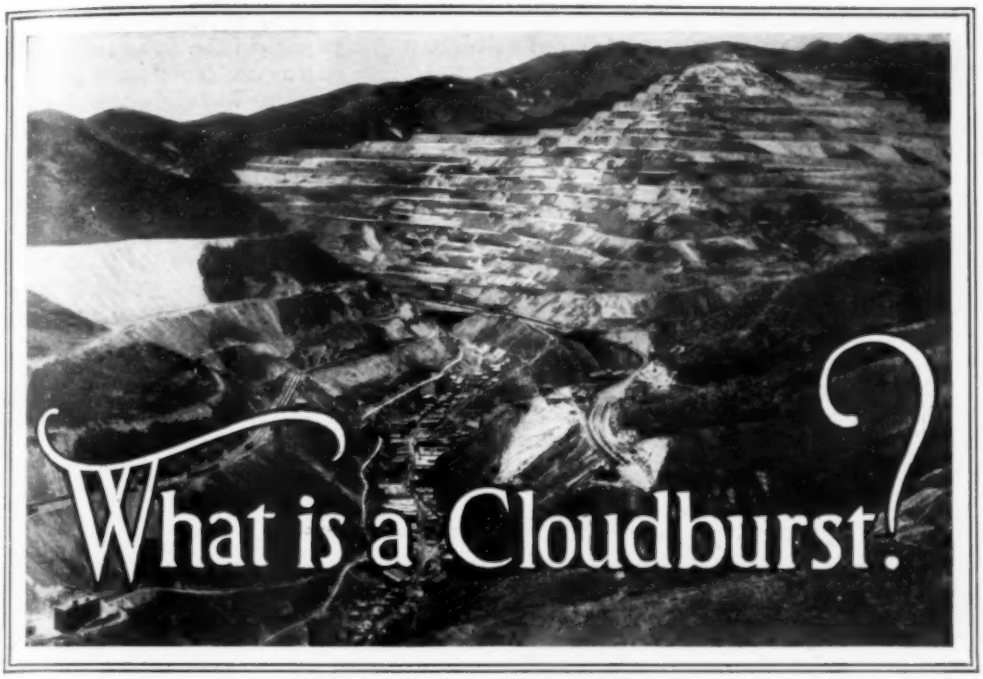
HEAT GENERATED BY MOTORS USED TO WARM BUILDING

Heating effects of electrical rotating machinery are no longer entirely lost because temperature increases caused by resistance, eddy currents and magnetic effects in direct-current and synchronous motors and generators are being used to warm the buildings housing the equipment. In recent installations, sheet-metal hoods collect the air warmed by the revolving machinery and transfer it to ducts which carry it where it can be used for heating. In the summer it is exhausted in the open to keep the building cool. Made to take advantage of the ventilation characteristics of the machinery, the hoods greatly reduce windage losses.

OXYGEN-BREATHING ROOM AIDS PNEUMONIA VICTIMS

One Chicago hospital has been equipped with an oxygen room for the treatment of persons suffering from pneumonia, asphyxiation and other critical ailments of the respiratory system. The patient is given a supply of oxygen mixed in proper proportions through the special apparatus with which the quarters are equipped. There are only about half a dozen such rooms in the country.

Oxygen-Breathing Room in a Chicago Hospital fo Treatment of Persons Suffering from Pneumonia



View of Bingham Canyon, Utah, Which Was the Scene of a Devastating Torrent Only a Few Months Ago; in the Background May Be Seen One of the Largest Open-Cut Copper Mines in the World

By C. F. TALMAN

SEVERAL destructive cloudbursts are reported every year in the United States. Last fall, while the most severe drouth in American history was at its height, two of these events made first-page news in the daily press. One took place in the twin towns of Nogales, on both sides of the boundary between Arizona and Mexico, where semi-desert conditions usually prevail. A sudden downpour during the night converted the streets into raging torrents and a score of people were drowned.

In the other case, a temporary river, several feet deep, roared down the single long street of Bingham Canyon, Utah, below the world-famous open-cut mine of the Utah Copper company. Three houses were washed away and mud was piled up, in places, to a height of eight feet. Bingham, like Nogales, is located in a normally semi-arid region, and it is in such regions that some of the most remarkable downpours on record have occurred. A cloudburst is an excessively heavy local downpour of rain, of comparatively brief duration. In its intensity and its concentration in space and time, it bears much the same relation to a wide spread heavy rainstorm as does a tornado to an ordinary cyclonic storm. The name of the phenomenon is popular rather than scientific and no hard-and-fast definition of this name has ever been adopted.

Of course, we know today that a cloud is merely a collection of very fine droplets and not a coherent mass, such as might be subject to any process of rupture. Moreover, modern research has revealed the fact that the clouds contain surprisingly little water. The very densest clouds are probably not more than one part water to 30,000 parts air, and it is computed that, if a huge thundercloud several miles in depth were, through a miracle, precipitated en masse to the ground at the maximum speed of falling rain, the resulting rainfall would be decidedly less intense than often occurs in so-called cloudbursts.

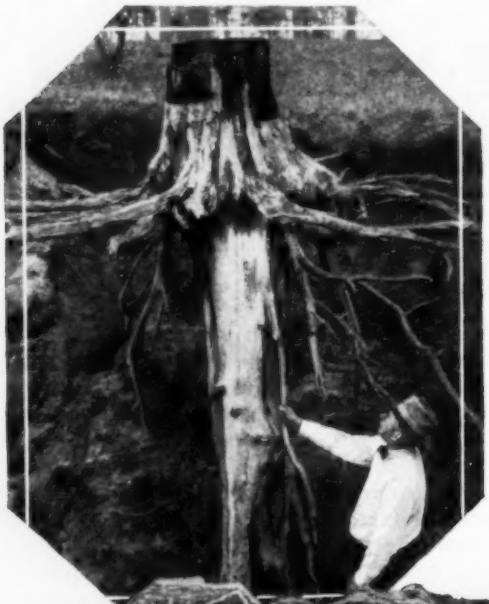
One of the fastest showers ever measured with an automatic rain gauge was that of May 1, 1908, at Porto Bello, on the Isthmus of Panama, in which 2.47 inches fell in three minutes. This rate of fall

was surpassed on April 5, 1926, at Opid's Camp, in the San Gabriel mountains of California, when 1.02 inches of rain—equivalent to 115 tons of water per acre—fell in one minute. This remarkable downpour was caught by two automatically recording gauges, standing side by side, and as their records agreed, the figure just quoted is entirely trustworthy.

While this figure stands, for the time being, as a world record so far as actual measurements go, it certainly does not represent the greatest possible intensity of rainfall in a cloudburst. Evidence of much more excessive falls is supplied by the huge holes, known as "cloudburst cavities," found after cloudbursts at places where they were evidently produced by the direct impact of the falling water and not by rapid run-off from some adjacent area. Observers have described these cavities in some cases as resembling the work of the hydraulic "giant" used by gold miners.

Eyewitnesses of cloudbursts have frequently described the water as coming down in masses or streams, rather than in drops. The earlier scientific attempts to account for these tremendous downpours assumed that the water was due to rapid condensation in the vortex of a tornado or waterspout, and hence the name "waterspout" was formerly often applied to a cloudburst, even when it occurred far from any body of water. The rainfall attending a tornado is doubtless sometimes of cloudburst intensity, but the majority of cloudbursts are now believed to be the product of thunderstorms. Violent uprushing currents of air always occur at the front of an advancing thunderstorm. Moisture in the air drawn into the storm by these currents condenses as it rises on account of the cooling of the air by expansion, but the upward blast is so strong that for a time the water is prevented from falling as rain.

If the rising currents are weakened at some point, a large accumulation of water is permitted to fall at one time. This is especially likely to occur when a traveling thunderstorm, which is fed by rising



Above, Remarkable Example of What a Cloudburst Did to a Hillside; Below, "Toadstool Park" in the Bad Lands of Nebraska, Where Heavy Rains Have Sculptured the Earth into Weird Forms

streams of air from overheated ground, passes over the cooler surface of a mountain, so that its supply of warm air is temporarily cut off. This would explain the special frequency of cloudbursts in mountainous regions.

The rainfall and runoff of cloudbursts produce their most striking effects in lands where the normal rainfall is so light that there is little or no vegetation to protect the ground from washing. The weirdly sculptured landscapes of the Bad Lands are the result of occasional torrential showers in a region where dry weather is generally prevailing.

A cloudburst is rarely a welcome event, but one that happened near Lake City, Colo., in the summer of 1929 scoured the hillsides and laid bare valuable deposits of ore, starting a small gold rush to the locality. A similar downpour many years ago in the same region is said to have brought to view several million dollars' worth of gold and silver.

Aerial View of New York's Elevated Highway along the Hudson River, Where Autos Travel without Interference from Cross Traffic

FLAME BALANCED ON AIR JET IN FIREBOX OF BOILER

Just as a light celluloid ball may be balanced on a vertical jet of air beneath it, so an inferno of fiery coals is kept aloft and flaming in the firebox of a large boiler by a draft of air entering below the grate. Crushed coal is used for fuel, the light particles being carried high up in the firebox, while the larger, heavier ones remain nearer the grating through which air enters. The heavy ashes drop out of the suspended fire. Very inexpensive operation and the use of cheaper fuels are claimed for the system, wood refuse having been burned satisfactorily and several installations being in successful operation.

ELEVATED HIGHWAY FOR AUTOS SPEEDS NEW YORK TRAFFIC

Automobile traffic in New York is being speeded up by the construction of elevated highways above the streets for fast travel. One such overhead lane extends north and south along the Hudson river waterfront where cars can travel at a fast clip without interference from cross traffic

MOST ANCIENT AMERICAN CITY

Santo Domingo, capital of the Dominican republic, is the oldest city in the new world settled by Europeans, but Panama City, founded by the Spanish in 1519, claims to be the oldest white settlement on the mainland of the Americas. There are, however, older cities of native origin. Mexico City, according to Aztec tradition, was settled about 1325.

A PAGEANT OF TRANSPORTATION IN FRANCE

Changing Styles in Travel Were Reviewed at a Transportation Pageant Held in Granville, France, Recently; in the Photograph Above Are Shown an Egyptian Palanquin and a Roman Chariot, While at the Left Is a "Litter de Luxe" of the Middle Ages; Persons in the Procession Wore Costumes of the Periods Represented, So That the Event Gave an Interesting Picture of the Changes in Dress as Well as in Vehicles; the Earliest Chariots Were Commonly Used in Warfare; They Were without Springs, Generally Carried Two Men and the Wheels Were of Wood Strengthened with Metal and Often Had Bronze Tires; the Assyrians Are Credited with the Addition of a Scythe or Sharp Knife to the Axles to Help Cut Down the Enemy in a Charge

© P. & A.

How Beauty Rode in Olden Days; the Bearers Were Experts at Keeping Step to Give an Even Motion

SHOWS OVER TWENTY CENTURIES OF TRAVEL

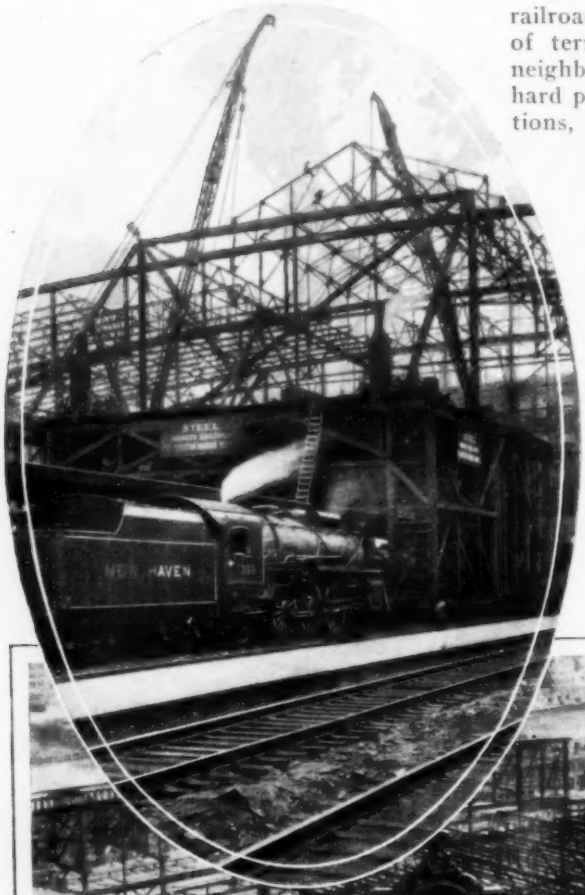
Above, a Modern Locomotive beside a Tiny Buddicum Engine, Built in 1840 and Which Has Been in Service between Granville and Paris for Seventy-Five Years; at Right, an Early Model of the Automobile; Its Top Is Borrowed from the Horse-and-Buggy Days; Note the Smaller Front Wheels and the Steering Grips Operated from the Right Side; Remarkable Improvements in Design Constitute One of the Chief Triumphs in Motor-Vehicle Progress, a Development Second Only to the Gain in Mechanical Efficiency of Engines and Other Parts

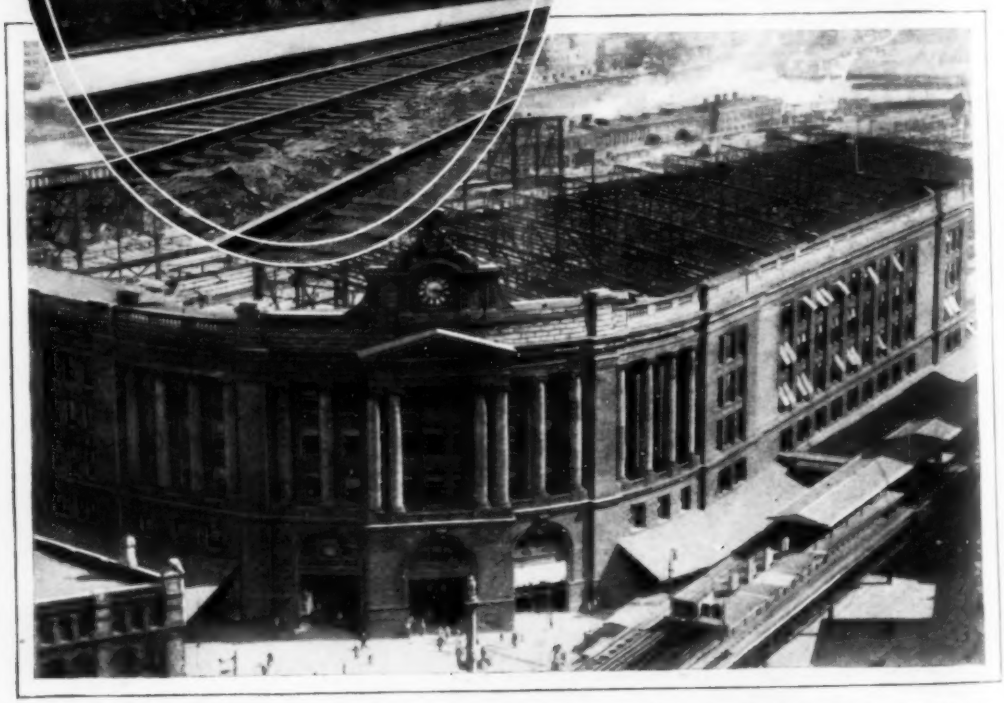
Bicycles of the Years 1840, 1860, 1890 and 1892, from Left to Right; the Gay Nineties Were Made More Gay with the Bloomer Costumes for the Women

Lower Photo © P. & A.

RAZING RAIL DEPOT TESTS SKILL OF ENGINEERS

Razing the largest train shed in the United States and replacing it with modern platform canopies; removing three miles of passenger platform and rebuilding it with concrete; shifting twenty-eight railroad tracks; setting 60,000 square feet of terrazzo floor and spreading in the neighborhood of 100,000 square feet of hard plaster, under more ordinary conditions, wouldn't be so much of a job for building wreckers and constructors to pull off in a year's time. But in rebuilding the spacious concourse of the South Station in Boston, conditions were far from ordinary. In number of passengers arriving and departing, this station stands third in the country. Each day more than 100,000 people traverse its platforms and the concourse; 535 trains arrive and depart every twenty-four hours—a train every three minutes. The big problem involved was to carry out the modernization of the station without in any way delaying the stream of traffic. In doing it,





Above, Close-Up of Movable-Derrick Mount Used in Demolishing a Boston Train Shed without Interfering with Trains; Below, Station with Center Section of Train-Shed Steel Removed

several new methods were evolved and some records were made. The removal of the big train shed was the most spectacular piece of work. An eighty-five foot boom was the longest practicable to use, so the derricks had to be mounted forty feet above the tracks. Tearing down and rebuilding the mounts each time a move was necessary would have consumed too much time, so two special mounts on sixteen railroad trucks, wide enough to span four tracks, were constructed. A secondary set of wheels allowed sideways movement across the platforms without dismounting the derricks. The contractors estimate that the use of the movable mounts saved six months of work. Installation of the modern canopy coverings—or butterfly awnings—for the platforms kept pace with the removal of the shed, so that passengers would not be exposed to the weather.

COTTON-FIELD DUSTER COVERS SIXTY ROWS AT A TIME

Covering sixty rows at a time, a mechanical cotton duster used by southern growers is able to treat twenty-five acres an hour, or 200 acres a day. The duster is mounted on the rear end of a tractor, close enough to the driver so that he can control the flow of calcium arsenate. A fan, housed below the hopper, and the agitators inside the hopper are driven through shafts and gears by the power take-off. The hopper holds 150 pounds of poison dust which passes through an adjustable cone by gravity and suction action by the blower.

Cotton Duster Operated by Tractor, Which Sprays Sixty Rows at a Time and Covers Twenty-Five Acres an Hour

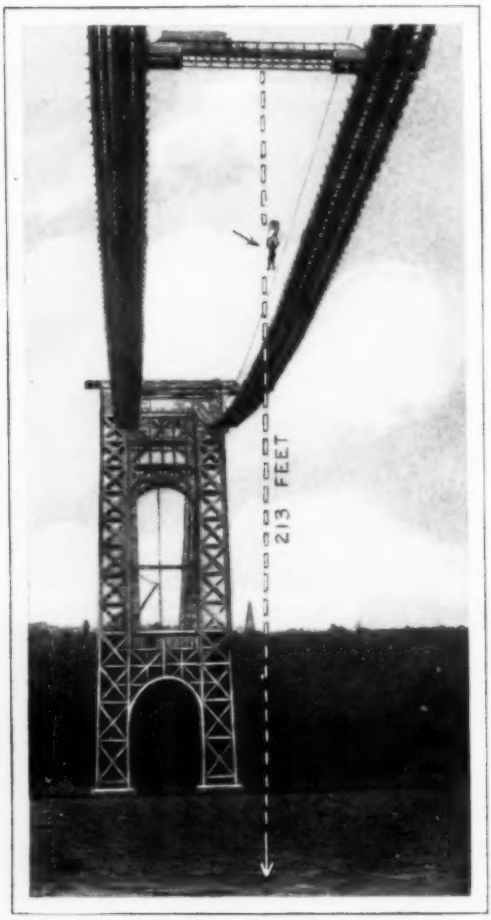
WATCH THAT SHOWS THE DATE GIFT FROM WASHINGTON?

Old Watch with Four Dials and Five Hands; It Shows Days of the Week and Date of the Month

In the private collection of an Indiana man is a watch that may be the identical timepiece which Washington presented to Lafayette as a token of his appreciation of the services rendered by the famous Frenchman. That a watch was given is a matter of record, and it is also a fact that the present was stolen from Lafayette's quarters. The collector's watch fits the description of the historic timepiece, experts say. It has four dials and five hands. One of the dials records the days of the month and another the days of the week. A miniature portrait bust of Washington appears on the upper side of the face. It is in colors and is considered a masterpiece of craftsmanship.

FLOATING POWER PLANT

To serve cities and industries along the New England coast, the former shipping board steamer "Jacona" is being converted into a floating electric-power plant. A 20,000-kilowatt turbine generator is being installed on board the vessel, which will transmit electricity to places unable to obtain sufficient power from land plants because of their location.



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High Diver Shown as He Jumped from Hudson River Bridge; He Was Killed in the 213-Foot Plunge

BANNER CARRIED BY HIGH DIVER FAILS TO SAVE HIS LIFE

Attempting a 213-foot dive from the center of the Hudson river bridge in New York City, Norman J. Terry, a stunt performer, lost his life when a blue banner which he carried failed to keep him in a perpendicular position until he struck the water, as he had expected. He jumped, head first, from the center span, remaining in perpendicular position until a few feet above the water when his trailing banner apparently hit dead air, flipping the diver on his back, which was broken when he struck the water.

SUPERCHARGER FOR SMALL CAR INCREASES ACCELERATION

Superchargers intended particularly for small automobiles, and especially for model-A Fords, now are available. The device fits over the regular carburetor and is clamped into place. Increases of thirty per cent in acceleration, ten per cent in speed, and ten per cent in mileage are among the claims made for the charger when applied to small stock cars. Power for the supercharger, which supplies a perfect mixture of gasoline and air for firing in the cylinders, is derived from the crankshaft.

PLANE IN FLIGHT TAKES FUEL FROM SPEEDING AUTO

Fuel was transferred successfully from a speeding automobile to an airplane in flight above it in a recent test at Alameda, Calif. The automobile headed into the wind as the plane approached, and when both were traveling at approximately the same speed, the ship was nosed down until the pilot was able to grasp the handle of a five-gallon can of gasoline held upward for him by one of the occupants of the open car. The success of the experiment was due primarily to the comparatively low speed which the small plane was capable of making. This craft, weighing only 450 pounds, and with a wing spread of thirty-four feet, has a landing speed of about thirty-one miles, and when flying into the face of even a ten or twelve-mile wind, its actual speed over the ground is cut to about twenty miles an hour.

Here Is an Airplane Refueling on the Wing, the Pilot Snatching a Can of Gasoline from a Speeding Automobile

MODELING GLASS FLOWERS SOON TO BE A LOST ART

Left, Glass Model of Cotton Plant in Bloom; Right, Coffee-Plant Model; In Circle, Repairing Crack in a Model; Below, the Clove Plant

The world is about to list another lost art, one that came into being less than a half century ago and yet is doomed to pass within a few short years. For Rudolph Blaschka, maker of the famous glass models of flowering plants in the Ware collection at Harvard University, has passed his seventy-third birthday and feels that he has few more working years ahead of him. And there is no one else in the world who knows how to make glass flowers like his. Many master workers have tried to duplicate the products of the art started by Leopold Blaschka, father of Rudolph, forty-five years ago. All of them have failed. For a Blaschka model is as the flower itself; root, stalk and bloom are there in faithful detail.

Just recently, there arrived from the Blaschka studio at Hosterwitz, near Dresden, Germany, a consignment of twenty-five specimens representing the entire product of six years' work by the artist-glassworker. Perhaps another genius, capable of carrying on the work, will rise after Rudolph Blaschka has passed on. He has promised to leave behind complete written details of how the glass is fused upon the tiny wires and how the coloring is attained. But Louis Bierweiler, who is devoting his life to the preservation and cataloging of the collection, as the Blaschkas have to its creation, points out that even with this detailed information at his command, it will take a most extraordinary person to add to the collection specimens worthy of a place beside the work of the two masters.

BULLS ARE SHOD LIKE HORSES TO PREVENT SORE FEET

Ranchers in Nevada are putting shoes on their bulls to prevent sore feet among the animals which roam the rocky fields. A special bull shoe of two pieces is used by the blacksmiths because of the cloven hoofs of the cattle. The animals are placed in a frame which prevents them from attacking the blacksmiths.

In DAVY JONES'

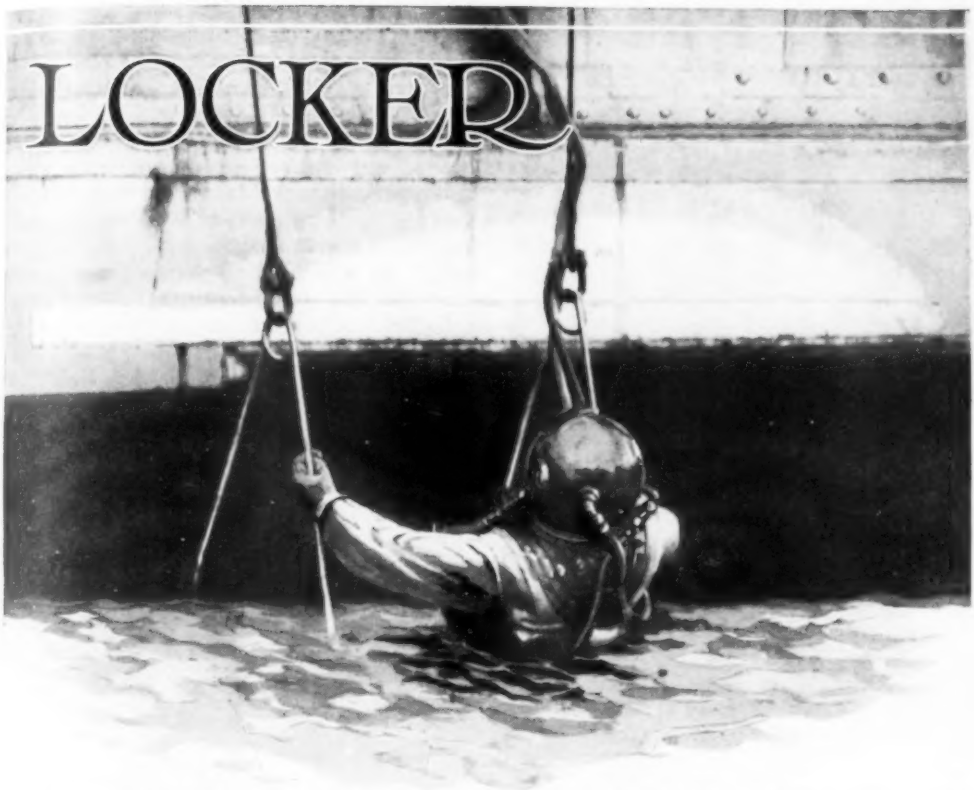
Diver, Expert in Salvage Work, About Ready to Descend with Torch That Cuts under Water; Below, a Freighter Beached by Storm

By DON GLASSMAN

A FRIGID tide swept out of Long Island sound and snarled at the west end of Fisher's island, where the government was building a lighthouse. A ridge of granite shaped like a turtle's back was the construction base. They called it Race Rock because the water literally races across the granite bottom. Nothing could buck the current. Derricks, tugs, lighters and other man-made structures snapped their anchorage. A veteran diver was pulled out half dead from fighting for a foothold. Engineers found a substitute in Alfred Pahlberg, a young sailor. They lowered him in the teeth of a raging sea, and he joined the seven-ton blocks into a foundation that resists the elements to this day.

Race Rock lighthouse, near the

Courtesy Merritt, Chapman and Scott Corp.



Lieut. Commander Ellsberg, U. S. N., Retired, Who Went Down to the "S-4"; He Was Caught in the Wreckage but Freed Himself by Inflating His Suit with Air from the Air Tube

harbor of New London, is a monument to Alfred Pahlberg, master diver, now eighty-three years old. When the sea retreats, and geologists examine the footprints turned to rock, they will find his impression more abundant than all others. The ocean bottom, from Canada to Key West, thousands of square miles, bears the imprint of his iron shoes.

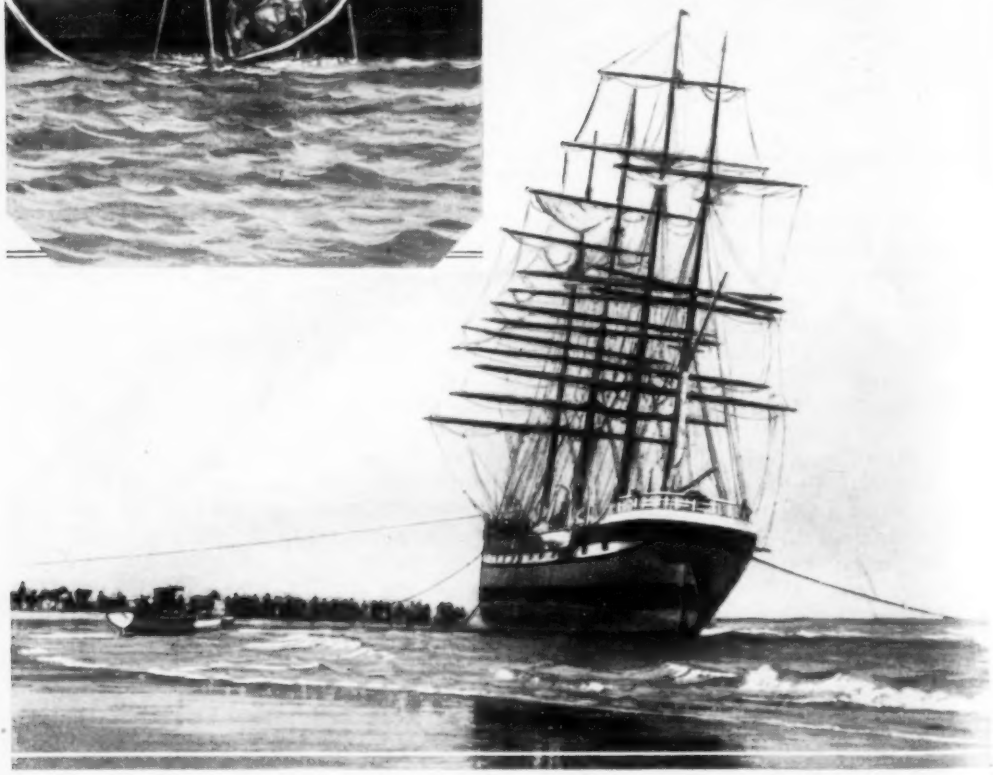
This son of Neptune has walked the sea floor for fifty-six years, and is still a familiar figure on the New London docks. His hair and beard turned snow-white, he will not go home and call it a good half century's work. He patches worn diving suits, repairs helmets, and casts a wistful eye at young divers off for a stroll on the sea bottom.

In thousands of dives, Pahlberg thinks his challenge to death was almost met when he dived once on a wrecked vessel and her cargo of scrap steel. A clamshell bucket would bite into the heap and hoist a load to the surface. The bucket did not work to satisfaction, and Pahlberg went to investigate. In shifting about, his hose and line became tangled with the bucket's block, and when the winch began to haul it up, Pahlberg felt his air hose taut and the life line all twisted in the cable. Sixty feet to the surface, and the water like blue ink! The air supply could hardly sustain him. The worst part of his predicament was that he couldn't signal, and if his tender had chosen to raise the bucket, the air line would have snapped. But a tender has an uncanny sense of what goes on beneath the surface, and this one felt that he ought to ease the tension on the clam shell. He did, and Pahlberg was able to unknit the knots.

While working on the foundation of Race Rock lighthouse, he recalls that an assistant was trying to drop a chain on the end of a long boat hook. Pahlberg saw it coming down, and reached for it. Just then, a wave tossed the rowboat. Boat

hook and chain smashed into his helmet glass. There was a blub-blbblbblbblbble as water displaced the air and gushed into the diver's suit. Pahlberg conserved his breath. He was 100 feet from the tender barge, and although he signaled the alarm immediately—three jerks, to come up—and the assistant also cried out, it was several minutes before they could pull him to the surface against a strong undertow. He was helpless when they hauled him out, but was revived by rolling over a barrel. After drinking coffee, he went down again.

About twenty years later, Pahlberg dived to patch the hull of the yacht "Iolanthe." A sleek sea bird, she lay keeled over on her beam ends. Silt washed in by tide and current had lodged around her bow and settled three feet thick. The light was pale, for the depth was about forty feet. Each step of the diver stirred clouds of thick murk, and he groped about by sheer instinct. Some-



Lower Photo Courtesy Merritt, Chapman and Scott Corp.

Above, "Bill" Wickwire, the First Diver to Go Down to the "S-4" and, Below, a Large Four-Master Beached High and Dry after a Severe Storm

where near her keel, a ragged hole had been torn in her hull, but it defied discovery. The suction pump snaked its way down from the surface, and Pahlberg caught its nozzle. Painfully he slogged

Courtesy Merritt, Chapman and Scott Corp.

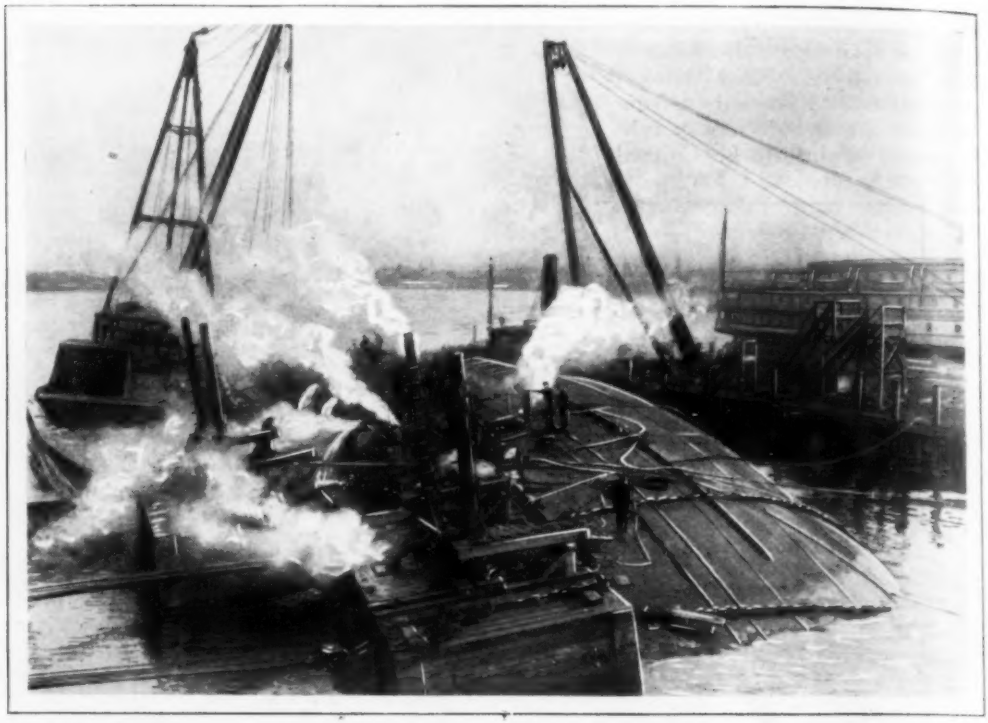
The S. S. "Ponce," Sunk at Her New York Dock, and, Below, Diver Frank Crilley Being Lowered to the "S-4"

through the ooze and buried the intake about amidships. He signaled. The wire-wrapped hose stiffened and with a bubbling snort the suction ripped into the tons of mud and gulped hungrily. On turning, Pahlberg felt his foot lifted and drawn toward the nozzle. It was caught in the suction and held firmly against the intake, but fortunately his iron and lead shoe was too large. He signaled to stop the suction, but the tender misunderstood, and thought the diver wanted to come up. Pahlberg received a tug on the life line and that threw him off balance, and he fell, his entire weight falling on the caught foot. The suction held on tenaciously; his ankle snapped like a thread; bones and tendons were wrenched. All his weakening efforts availed nothing. He gave a despairing signal at the life line. By this time the men above understood the message and the pumps stopped.

One of the largest submarine construction projects had to do with the South Union depot, in Boston. Over a site of fifty acres many gangs of men swarmed about doing odd jobs, but on the edge of the site, Pahlberg and another diver worked for months to clear the channel along the line of a large wall that was to keep the sea from encroaching on the station. When the tide was low, they would dive down with a four-inch suction pump, which made the silt piles vanish as if by magic.

The ordinary diver's costume is a one-piece suit of tough rubber fabric. When inflated, it is smooth and easily slips away from projections which might tear it. In general, says Pahlberg, diving outfits have not changed since he first began diving. He used one type of helmet for twenty years. The present type has a valve which the diver manipulates and allows the escape of as much air as he pleases. Another improvement has been on the pumps, but in some cases it still is necessary to pump by hand. The deeper the dive, the more air pressure necessary, until, at a depth of 270 feet, about 120 pounds are needed.

Once Pahlberg was kneeling on the



Derricks Tackling an Overturned Freighter; Salvage at the Docks Is Usually Less Hazardous than in the Open Sea but Often Is Just as Difficult

ocean floor, and happened to rest on an oyster shell. It cut a hole in his suit and he felt the water gush around his unprotected body. The air came down to him with just enough pressure to keep the water level at his chin. He felt no necessity for raising an alarm, but continued at his work. In fifteen minutes, he signaled to come up, and to the surprise of other veterans, told of working at a depth of thirty feet with water up to his chin.

Besides ships, a diver goes after many smaller objects. Pahlberg has recovered a lost watch on the ocean bed.

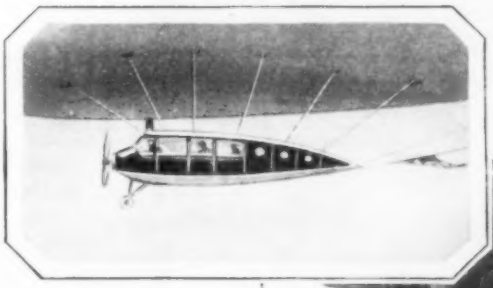
ULTRAVIOLET RAYS GIVEN OFF BY ORDINARY GAS STOVE

Ordinary gas stoves, in which the clay radiants are heated to incandescence by means of Bunsen gas flames, are excellent sources of infra-red radiation. Owing to their low temperatures, however, these radiants, even when covered with special materials claimed to emit ultraviolet rays, do not give off enough of such radiation to make them useful for healing purposes. It has been established that the intensity of ultraviolet light emitted by a gas stove is only a minute fraction of that of similar ultraviolet waves in sky radiation.

AUTO BRAKE-LEVER EXTENSION WITHIN EASY REACH

For Ford cars with the button-type emergency brake, an extension brake handle as an accessory brings the lever within easy reach of the finger tips. It consists of a rod set at right angles to the standard lever, the top resting on the release button. A pull on the extension handle depresses the button and allows the brake to be set, and a touch releases it. It can be attached in a few minutes.

DIRIGIBLE AIR YACHT HAS AN AUTOMOBILE CABIN

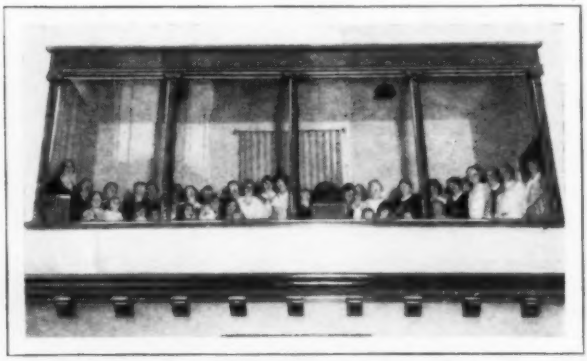


Two Views of Cabin of a Tiny Dirigible Moderate in Price; Note Landing Wheels Which Convert It into an Auto Trailer

Carrying four persons at a speed of sixty-five miles an hour, a tiny dirigible suited to the needs of an average family has been built to sell for about $10,000. The craft is 104 feet long, twenty-seven feet in diameter, and has a gas capacity of 39,000 cubic feet. It is inflated with hydrogen, and has a streamlined twenty-two-foot mahogany cabin, in the nose of which is a 100-horsepower air-cooled motor which drives the propeller. The little air yacht is without girders, buckling being prevented by a lower compartment into which air is forced before a flight with an ordinary vacuum cleaner. After the ship is in flight, this compartment is kept filled by an air scoop above the cabin. No ground crew is required, the craft being landed easily anywhere and moored by one man to a post or other anchorage. The gondola is mounted on caster wheels, allowing the ship to swing in the wind, and, if caught in a gale, the dirigible has a zipper arrangement in the bag which rips open when the mooring cable is pulled with violence, thus causing the bag to collapse. The ship can be slowed without losing buoyancy, and the average person can learn to manipulate it in a few days. Its weight is about 1,700 pounds, and the useful load 850 pounds. The hull is of rubberized and aluminized-cotton fabric. The engine is equipped with a self-starter and the vessel has a cruising radius of about 250 miles, carrying three passengers. When the bag is deflated, it can be stored in the gondola, and the cabin on its wheels then can be used as an ordinary trailer to an automobile.

SUN'S RAYS ARE USED TO KILL RUINOUS BARK BEETLES

Solar heat has proved of economic value in the control of bark beetles and other destructive forest-tree insects. Tests by the department of agriculture show that the bark of a lodgepole-pine log will sizzle at from 110 to 120 degrees when the sun has warmed the surrounding air to only eighty degrees, and this temperature is fatal to the insects. Bark temperatures of 140 degrees have been observed when the air temperature was only eighty-nine degrees. Bark beetles are among the most destructive insects attacking western pines, all species causing a timber loss estimated at $20,000,000 annually. The method of killing the beetles by exposing felled logs to the sun for four or five days has been found much simpler and less expensive than burning the bark off the logs



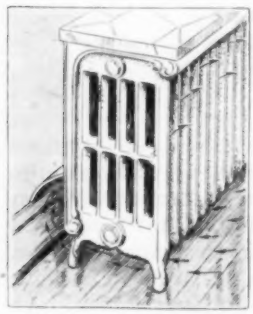
Soundproof Room in a Church for Mothers and Babies; Restless Infants Cannot Be Heard by the Congregation

SOUNDPROOF ROOM FOR BABIES ADDED TO CHURCH

Mothers may bring their babies to a Los Angeles church without fear that their cries will disturb the rest of the congregation. Above the foyer of the church has been built a soundproof room for mothers. The compartment has a glass front facing the auditorium and is equipped with a public-address system, so that mothers may hear the music and the sermon through loud speakers while caring for their children.

STEEL SHIELDS FOR RADIATORS KEEP THE WALLS CLEAN

Steel shields for radiators not only hide the unsightly heating equipment from view, but also keep walls and draperies from becoming soiled. A felt-edged steel strip near the bottom of the radiator extends from radiator to wall and keeps the moist, dust-laden air from being drawn up in this fluelike aperture. Concealed water receptacles in the shields control humidity, and circulation is governed and fuel is saved by delivering the warmed air at the proper levels. Low inclosures are suitable for window seats and decorative objects may be placed on the higher models, which are in many designs.

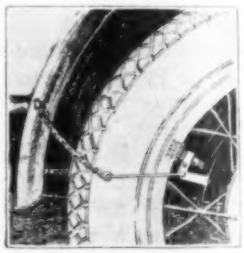


CHEMICAL SUBSTITUTE FOR ICE SERVES TO COOL DRINKS

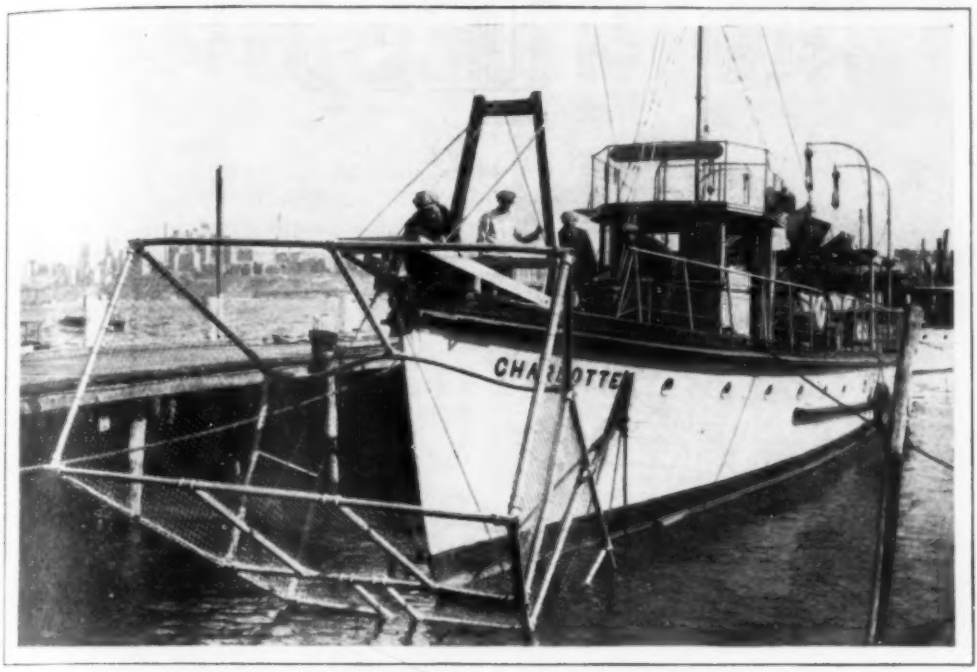
Drinks and other liquids are cooled by a chemical instead of ice. The substance is placed in a cone-shaped container which, in turn, is submerged in the glass or goblet. The inner chamber has a cover so that the chemical cannot come in contact with the drink. The substance is mixed with water and the cooling action is hastened by stirring the mixture to speed up dissolving. The chemical may be used repeatedly by placing it in a shallow dish after each operation and exposing it to the sun to crystallize it again. The method has been found especially successful in tropical regions where ice is difficult to obtain.

FLAT-TIRE WARNING SOUNDED BEFORE DAMAGE IS DONE

Audible warning of auto-tire deflation before the tire becomes flat is provided by an alarm which attaches to each tire valve. It consists of a heavy spring placed around the valve stem, outside the rim but inside the casing. This is compressed and the stem forced outward as the tire is inflated. After the tire is mounted, a mechanism is attached to the valve stem and clamped into position. This mechanism carries an arm to which is attached a clapper and chain. The arm is latched into position extending toward the hub of the wheel, but when the tire deflates, the latch is released and the arm flies free, striking the underside of the fender with each revolution of the wheel, thus calling attention to the leaking tire. The warning is set for the pressure carried by the tire, and may be reset at the danger point after a slow leak develops so that the car can be driven farther, but a signal will still be given if serious deflation occurs. The device does not interfere with tire testing or inflation.



FISHING MACHINE PUMPS CATCH FROM THE WATER



Boat Which Has Been Converted into a Fishing Machine and Pumps the Fish from the Water onto the Deck; in the Foreground Is a Net Which, When Lowered, Acts as a Chute for the Catch

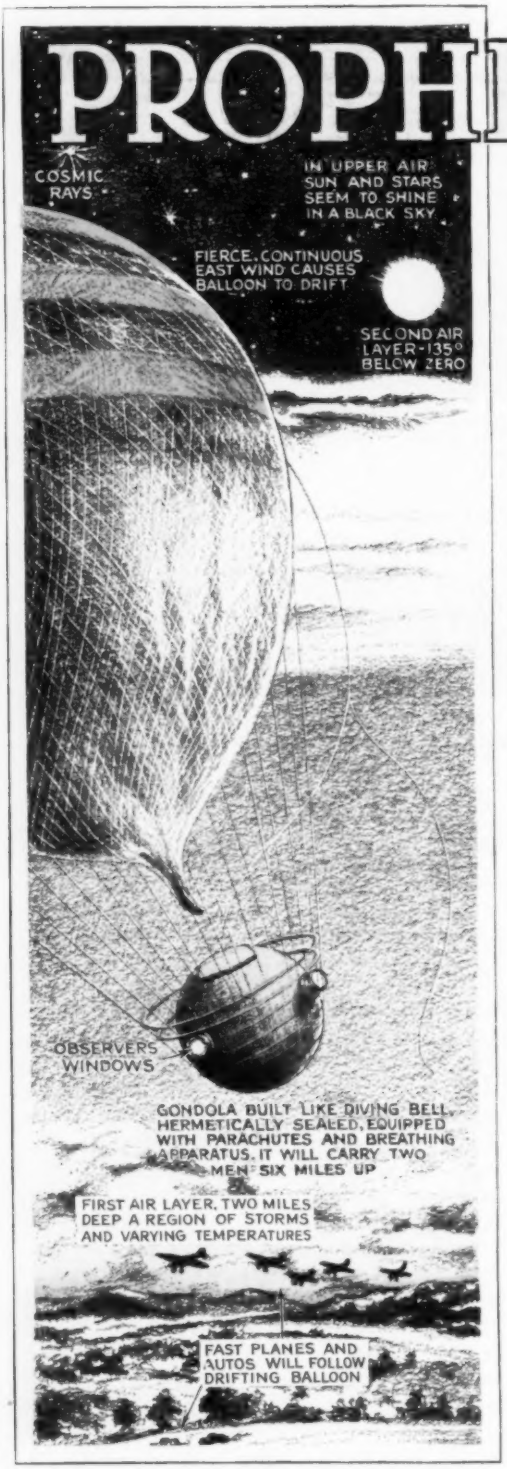
Catching fish at the rate of about twenty tons an hour is the feat boasted by a former submarine chaser which has been converted into a fishing machine. The craft has been fitted with a pipe, two feet in diameter, which extends beneath the water line and to which is attached a centrifugal pump. The pump creates a vacuum in the tube, thus literally sucking the fish into the boat. A net, acting like a cattle chute in the stockyards, is lowered about two openings in the bow connected with the pipe, and the pump is started, drawing air, water and fish into the tube where they are seized by the stream of water and shot to the deck in the stern of the boat. There the fish are dumped into a net. The principle is the same as used in the ordinary sand sucker employed to clean ports and river beds, except that the pump in a sand sucker is inside the main tube, and with the fishing machine it is outside. The machine will do the work of ten ordinary fishing boats, and with five men instead of twenty. At first, the boat is not to be used to catch edible fish, but to snare the inedible kind from which dry scrap, fertilizer and oil are obtained. The craft is equipped with a standard six-cylinder engine and an eight-horsepower motor to operate the pump.

AUTOS RIDE ON MULES' BACKS INTO FOREIGN LANDS

Camels and mules, primitive means of transportation in many remote countries, are working themselves out of jobs by delivering knocked-down American automobiles to regions otherwise inaccessible. Pack mules carry the disassembled autos into Colombia, about twenty-five different packages making up one car. For the heavier parts two mules are used, the chassis or other unit resting on two bars laid across their backs. Camel caravans are used to deliver cars in both India and Australia. Often a car, when finally delivered to its owner, has traveled by train, ocean steamer, railroad, and finally on mule back.

¶An outboard motorboat recently attained a speed of 50.93 miles an hour.

PROPHETS *and their*



Balloon with Air-Tight Metal Gondola, in Which European Scientists Hope to Explore Upper Air

OUR twentieth-century marvels revive memories of prophets, for they foretold that these inventions would come.

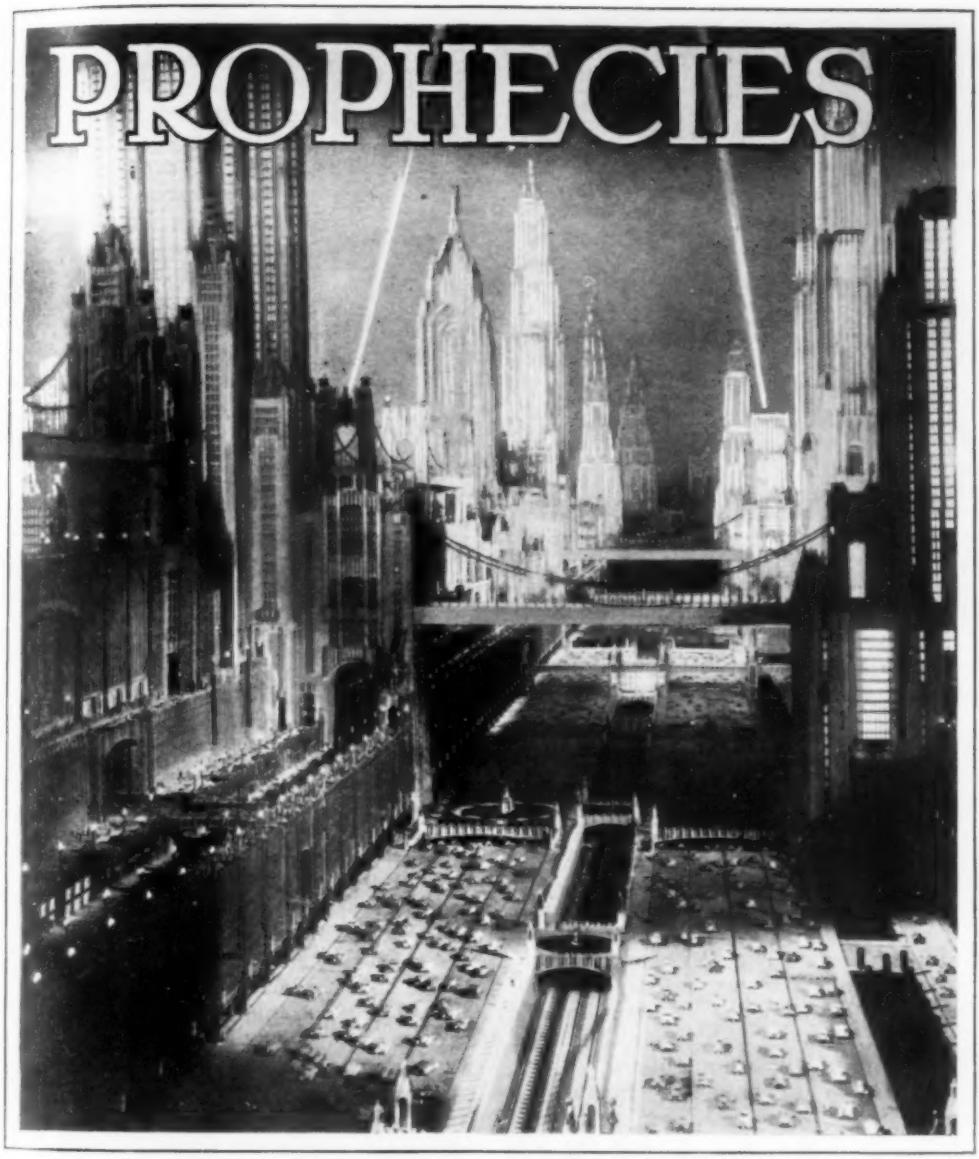
Automobile tires guaranteed for 20,000 miles and more remind one that Charles Goodyear prophesied that vulcanized rubber could be made as tough as flexible steel.

Watch multi-motored ships fly with the grace of birds, and parachutists plunge from a plane at several miles' altitude. Then fetch a volume of Leonardo da Vinci and note his drawing of a "tent-roof" parachute, and diagrams of airplanes constructed on the principles of bird flight.

When a chance street excavation exposes thousands of telegraph and telephone cables, we see another reality born of prophecy. In 1878, Thomas A. Edison, a former Morse operator turned inventor, predicted long-distance telephony even before Bell's invention had gone into use. He said:

"The telegraph company of the future—and that no distant one—will be an organization having a huge system of wires, central and subcentral stations, managed by skilled attendants whose sole duty it will be to give wires proper repair, and give, by switch or shunt arrangement, prompt attention to subscriber number 923 in New York when he signals his desire to have private communication with subscriber number 1001 in Boston for three minutes."

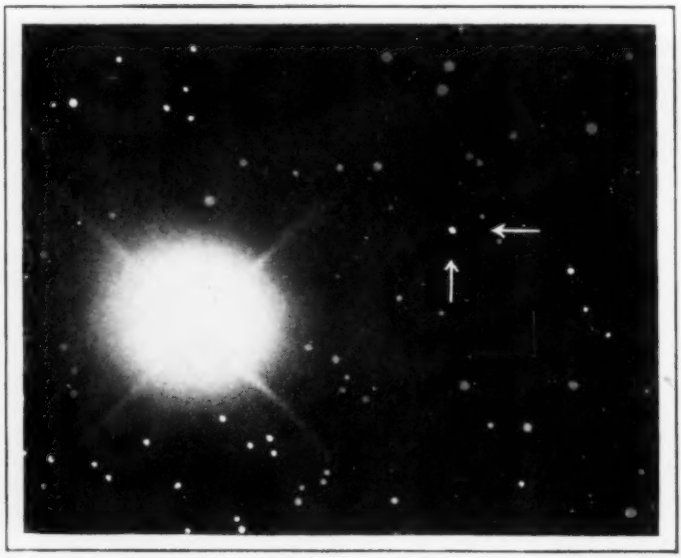
Inventors, however, are not prophets of the first magnitude. Sweeping discoveries often come from the imaginations of poets, playwrights and fiction writers. Three modern writers, Jules Verne, H. G. Wells and George Bernard Shaw have inspired inventors. Fifteen years ago, Shaw described television that made possible the transmission of moving images and voices. The invention was demonstrated this year in Schenectady by Dr. E. F. W. Alexanderson. Wells humanized Einstein's "fourth dimension" in a fiction story, "The Time Machine," published before the relativity theory gained currency.



Model in Miniature of the City of the Future as Conceived by the Staff of a Musical Production; This Model, with Nine Traffic Levels and Sky-Piercing Buildings, Cost $250,000

As for Jules Verne, he is the major prophet of modern civilization. In the strict sense, he was a scientist as well as fiction writer. He studied nature's laws with great industry and observed their application everywhere. His descriptions of airplanes, submarines, rockets and engines aroused jeers and hoots, and his defense was, "Man can achieve what man can imagine."

Recently, the French Geographical society celebrated the centenary of Jules Verne's birth, and paid especial tribute to him for contributions to aeronautics. While Otto Lillienthal was making his first flights in a glider, Verne drew a vivid word picture of a flying machine, "The Albatross," and in a now little-known book described what he believed would be the airplane of the future. His story, "Five Weeks in a Balloon," brought out Verne's individual theories for me-



Arrows Point to New Planet Found in 1930, Although Its Existence Was Predicted Many Years Ago by the Late Percival Lowell

chanical flight. "As to the future of aerial locomotion," he wrote, "it belongs to the airships (airplane), not to the aerostat (dirigible).

Outside aeronautics, Verne depicted cannon that would fire shells twenty miles. But in the last war, the German Big Bertha fired seventy-five miles; electric headlights such as are used on modern automobiles; bombs to release deadly gases; talking motion pictures and television.

Modern exploration recognizes a heavy debt to Verne. The Wilkins-Ellsworth transpolar submarine expedition was what Verne prophesied when he described the submarine voyages of Captain Nemo in the "Nautilus." And Sir Hubert Wilkins, in veneration of the Frenchman, has named the recommissioned submarine "O-12" "Nautilus," and as such she will invade the unknown polar sea.

As to utilizing the thermal energy in sea water, a practical experiment is now being made at Matanzas bay, Cuba, by Georges Claude, the French engineer, who concedes that the first inspiration for his work came from Verne's fiction.

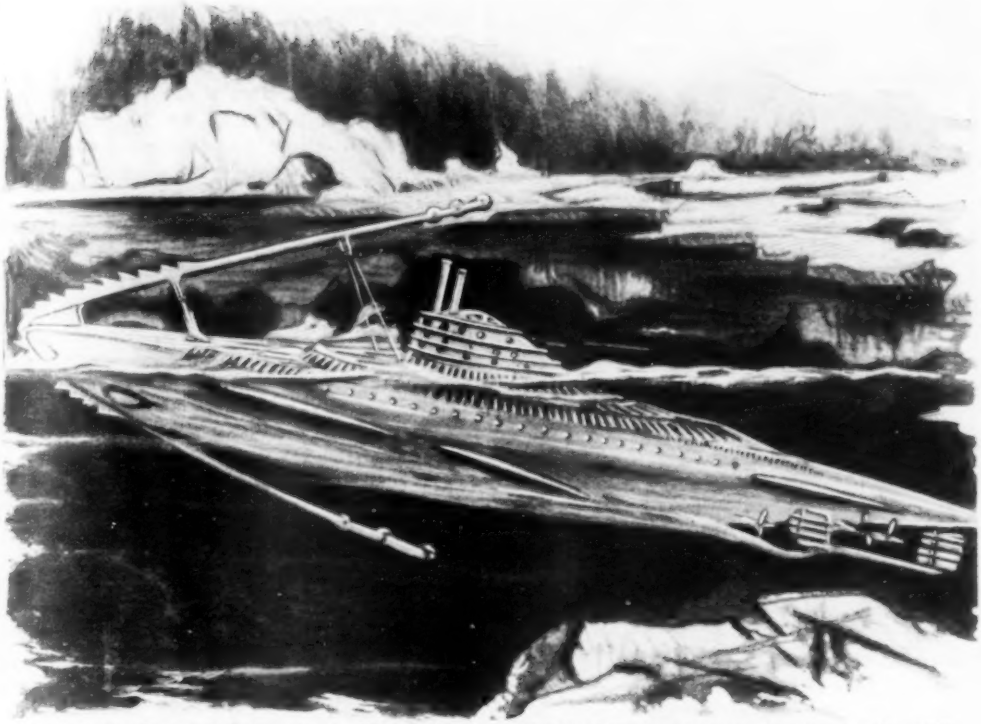
Just after finishing "Twenty Thousand Leagues under the Sea," Verne happened to see a travel poster, and the flash of its color gave him the incentive for a novel that brought him everlasting fame. "Around the World in Eighty Days" started globe-trotting marathons by men and women competing for prize purses. But eighty days is a snail's pace in modern travel. The "Graf Zeppelin" circumnavigated the globe in twenty-one days and seven hours.

Verne foresaw the skyscraper age. Advertisements, he said, would be projected on clouds. And they are! Sky-writing is now fairly common, too. Twenty years after Verne forecast the use of selenium in the transmission of pictures, it came about.

The great oracle passed away in 1905, living long enough to see a few of his ideas turned into actual inventions, but hardly realizing what great work he had done. Some of Verne's ideas are still in the fiction stage. For instance, he visualized travel between the earth and the moon, as well as around the moon; descent to the abysmal sea bottom (William Beebe has reached a depth of 1,426 feet); the manufacture of electric motive power for ships by using dissolved sodium in sea water, and the exploitation of submarine mines with submarine ships. Verne's helicopter has appeared, although not commercially.

The creative imagination appears at the oddest moments and places. There exists an amazing book, "Looking Backward," written in 1886 by Edward Bellamy. As its title suggests, this novel projects itself backward from the year 2000 A.D. The author describes musical broadcasting with such fidelity that it is hard to believe he never heard the radio. One of the characters touches "one or two screws and at once the room was filled with the music of a grand organ anthem."

There are prophets who sit at desks and peer into nowhere. The annihilation of time and space with mathematics is the triumph of the imagination over man's environment. We see it best in astronomers. There was Percival Lowell. With nothing at hand but paper and pencil, he



Drawing of a Proposed Submarine, in Which Scientists Would Attempt a Trip to the North Pole, Going under the Ice When Necessary; Note the Hook with Its Teeth to Cut through Ice

explored space 3,000,000,000 miles away and discovered a ninth planet, "Pluto"! He found it in his mind and believed it to exist. But it is not enough for a prophet to have discovered something—he must make it acceptable to everybody else. So Lowell wrote his prophecy as one would file a will.

Lowell died in 1916. But the search for "Pluto" was carried on in observatories all over the earth. Fourteen years they searched, and then came astronomy's greatest moment of the century. A photographer at Flagstaff, Ariz., found a spot on one of his negatives. He flashed the news, and soon observatories in England, France, Germany and Italy verified the truth in Lowell's prophecy.

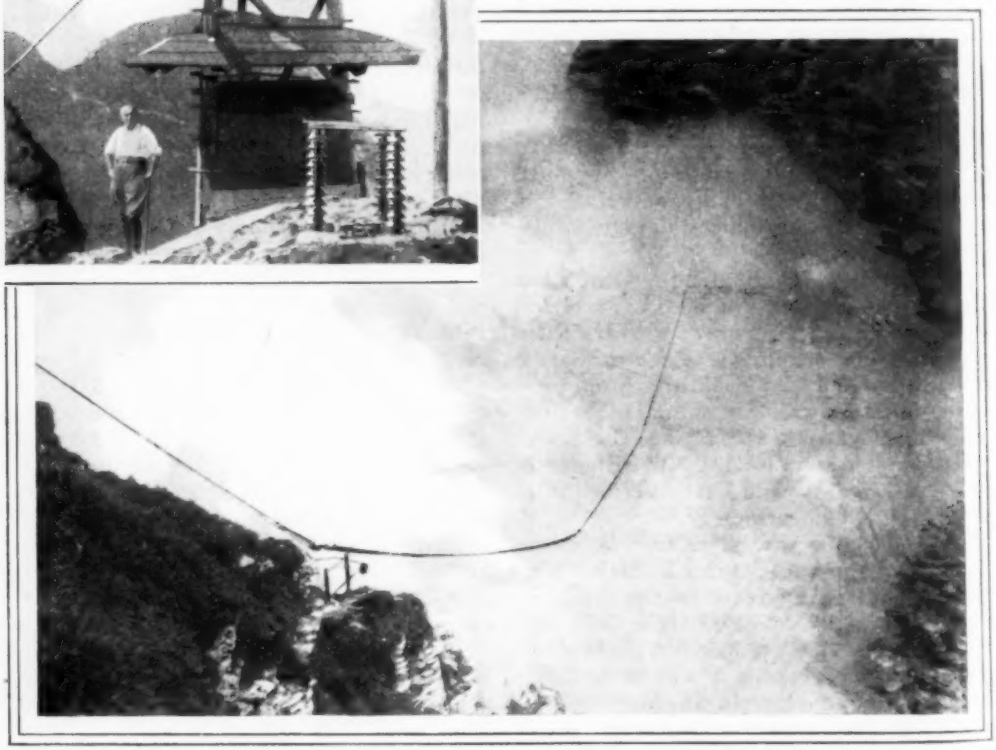
Of modern inventors, none was more astute than the late Charles P. Steinmetz, chief consulting engineer of the General Electric company. In 1915, describing the new electrical age, he said that when its use becomes universal, it will be against the law to have a fire in any part of the city. The government will prohibit fires, because they are dirty, dangerous and unsanitary. Big central power plants will do away with the hauling of coal from mines and railroad yards, and steam power may be generated by setting veins of coal on fire. The home will have no kitchen ranges, no cellar furnaces, no steam-power plants or gas engines. With electrical heating, we will simply set the gauge at the desired temperature.

It seemed ridiculous for this man to talk about international broadcasting in 1915, and millions of people hearing concerts in their homes. Yet, in the past seven years, the public bought 13,000,000 radio sets, and, in this country alone, the audience is calculated to be 50,000,000 persons. And because talking pictures had been a hoax ever since Edison's kinetophone, people were dismayed to hear Steinmetz say that the motion picture and talking picture would be perfectly synchronized. It has come about very rapidly.

To predict that private homes would have electrical heating, refrigerating and ventilating plants also seemed absurd. The home ventilating plant is a new vogue, but electrical icemen are found in one out of every ten families.

HUGE TOWERS DRAW LIGHTNING TO SMASH ATOM

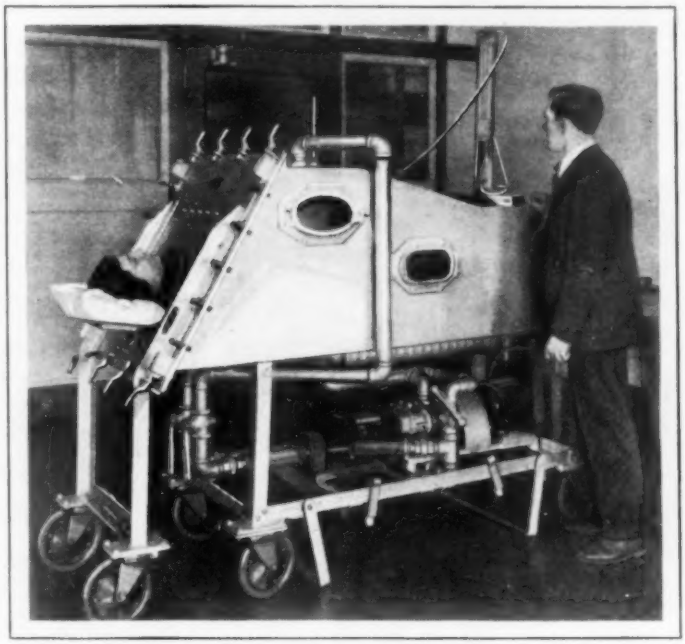
University of Berlin scientists are continuing their attempts to harness lightning in an effort to develop an electric current much stronger than any ever before produced by man. Through the use of a huge vacuum tube, the scientists hope to capture electric energy sufficient for the disruption of an atom. In the effort to draw from 5,000,000 to 6,000,000 volts of electricity from the air, the Germans have strung a 2,000-foot cable between two towers on mountain peaks in the Swiss Alps, where storms are frequent and violent. Scientists now generally accept the theory that an atom of matter consists of a number of electrons held together by a charge of positive electricity. Electrons move at a speed estimated at 160,000 miles a second and a few pounds of matter contain more energy than we could extract from millions of tons of coal. The problem is how to obtain sufficient energy to release the force of the atom, and therefore this attempt.



Above, One of Two Towers in the Swiss Alps between Which a Cable, Shown Below, Has Been Strung in an Effort to Trap a Charge of Lightning Powerful Enough to Smash an Atom

ARTIFICIAL LUNG ON WHEELS PROVES LIFE-SAVER

With the aid of the latest type of respirator, or artificial-breathing machine, a young woman nurse in St. Luke's hospital, Chicago, was kept alive for weeks while battling with a malady which had paralyzed her lung muscles. Persons overcome by gas, pneumonia and other victims have been treated in the cabinet which has just been introduced to the hospital world and which has been acclaimed as one of the most effective emergency aids yet devised. A metal chamber, with a sliding base upon which the patient is placed, an electrically operated pump, a gauge and a valve are the chief parts of the outfit. The patient is placed on the sliding bed, shoved into the cabinet and the shield tightly locked. A rubber collar, which fits so snugly that almost no air can pass, is adjusted about the patient's neck. A switch is turned, and the cabinet begins its work. This consists in simply creating a vacuum condition inside the chamber at regular intervals. The pump draws the air out, a valve opens and the air rushes back of its own accord. The vacuum causes the lungs to expand. When the air goes into the cabinet again, the chest and lungs are compressed, thus creating, artificially, natural breathing.



Patient in an Artificial-Breathing Machine, Which Contracts and Expands the Lungs When the Patient Cannot Breathe Naturally

GLUE FROM COW'S MILK

Casein glue, used in virtually all work likely to be exposed to the weather because it is waterproof, has as its main constituent the dried curd of ordinary cow's milk. It is made in powdered form and is virtually free from odor. It is mixed with equal parts of water and is now prepared in such form that it stays liquefied for an entire day while formerly the limit was about fifteen minutes. Ordinarily it is applied with a stiff brush and is used extensively in making and repairing cabinets, furniture, boats, radios, airplanes, gunstocks, automobiles, trunks and bags.

PLANE MOTOR MORE EFFICIENT THAN AUTOMOBILE ENGINE

Comparison of the practical efficiency of airplane and automobile motors gives the advantage to the former. An engine of one high-priced car under test developed eighty horsepower at 3,300 revolutions per minute, and weighed 700 pounds, or eight and three-quarter pounds per horsepower. An airplane engine, equally well known, develops 525 horsepower at 1,900 revolutions, or one horsepower for every one and one-quarter pounds of weight. The auto engine operates on an average of about twenty-five to thirty-five per cent capacity, while a plane motor operates at seventy-five to 100 per cent capacity. Some airplane engines have done 200,000 miles at full throttle and still are working smoothly, while the average automobile engine, after 50,000 miles at thirty per cent throttle, has outlived its major usefulness.

Portable Radio Set for Policemen, Which Transforms Each Officer into Broadcasting Station

RADIO FOR EVERY POLICEMAN TO WAR ON CRIME

Every London "bobby" will be his own broadcasting station if British policemen are equipped with portable radio sets, recently invented by an Englishman and equipped with both receiving and transmitting apparatus. The set, contained in a small case, fits on the policeman's belt and weighs less than five pounds. An opening in the side of the receiver allows the beams of one of the tubes to shine through, giving a better light than afforded by the ordinary electric flashlight. The case contains a two-tube sending and receiving set, batteries and a 100-foot concealed aerial. A wire running from the box to a specially designed helmet completes the equipment, which has a sending radius of from ten to twenty miles.

LEAD COAT ON THEATER WALL IMPROVES ACOUSTICS

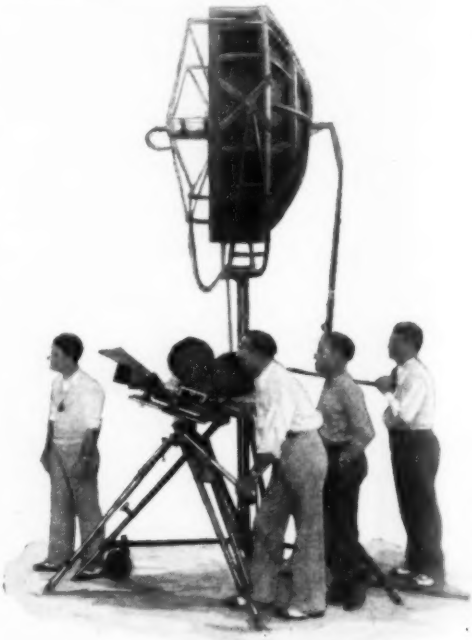
Lead slack, a by-product of lead processing, is being used in theaters to improve the acoustics for talking pictures. Building-board panels, covered with glue, were set in the walls and the lead was applied to the glue, after which window screening was placed over the panels and fastened with decorative molding strips. The paneling is employed to suit the acoustic peculiarities of the building being treated, for if too many are used, all the sound is deadened. Soft lights give the panels an appearance of mural decorations.

FIRST SPEED LAW IN AMERICA

America's first speed law was passed by the board of selectmen in Boston, in 1757, and limited traffic to a foot-pace on Sundays. This ordinance recited that "coaches, sleighs, chairs and other carriages" were being driven with great rapidity through the streets, and interfering with the Sabbath worship. If the walking pace were exceeded, the ordinance exacted a fine of ten shillings from "the master of the slave or servant so driving."

MICROPHONE PICKS OUT SOUND AT WHICH IT IS POINTED

Resembling a big loud speaker, a huge microphone which picks up only those sounds toward which it is pointed is being used in the making of talking motion pictures. The directional microphone has a great advantage over other sound equipment, since it eliminates much of the extraneous noises which the ordinary recording apparatus would pick up.



Directional Microphone, Used in Movies, Which Picks Out Only Sounds at Which It Is Pointed

CAMEL SHIPPED BY AIRPLANE ACROSS MEDITERRANEAN

With the distinction of being the first of its species to enjoy an air journey, a camel arrived recently at Ostia after an airplane flight across the Mediterranean. It was consigned to the zoo at Rome and was the gift of an Italian who chartered a passenger hydroplane to deliver it. It stood the air trip of four hours and a half without any apparent ill effects.

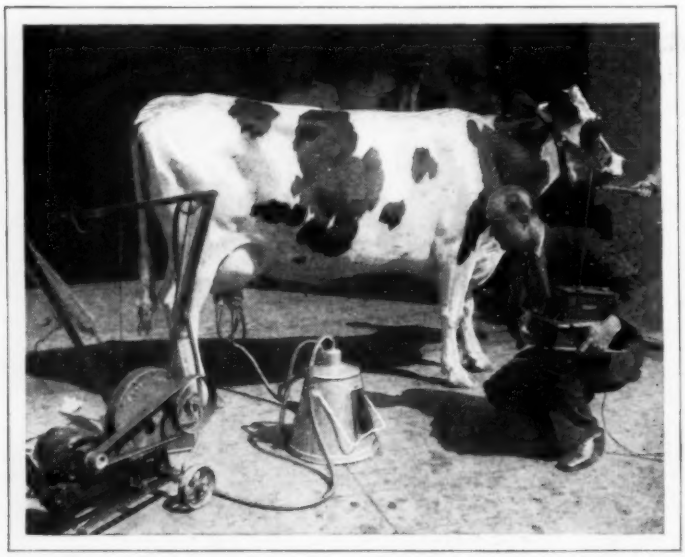
The Camel Coming Down the Runway Has Just Completed an Airplane Journey across the Mediterranean, Probably the First Animal of Its Kind to Take Such a Trip; It Was Sent to the Rome Zoo

AIR-FILLED BAGS SAVE PLANES IN WATER LANDINGS

Flotation gear has been adopted by the United States navy for its land planes to enable pilots to make a forced landing in deep water without undue risk of a fatal accident. The pilot of a bombing plane, so equipped, in time of emergency merely pulls a control lever which governs the automatic inflation of bags which keep the ship afloat when it alights. The bags are contained in a small compartment on each side of the fuselage. Each compartment has a panel door opening outward and downward, and in each is folded a bag of heavy gas-proof fabric, one side being permanently attached to the fuselage. The two bags are connected by steel tubing with a steel flask charged with compressed air or non-inflammable gas. A lever beside the pilot controls this air supply. When the pilot pulls it, the bags are inflated in thirteen seconds, and the doors to the compartments open automatically to release them. When the plane alights, it settles down until all but the top of the fuselage and the upper wing are submerged, the inflated gear keeping it on top of the water indefinitely in this position. The depth at which the ship floats enables it to rise and fall with the waves, thus riding out fairly heavy swells.

MITTEN FOR HUNTERS LEAVES GUN FINGERS FREE

Intended particularly for hunters, a wool mitten that leaves the fingers free to control a gun without exposing them to the cold is being offered to sportsmen. Either right or left palm contains a folding flap, permitting the wearer to thrust the fingers through this opening without removing the mitten. When the fingers are withdrawn inside the mitten, the flap closes to provide the usual warmth.



Milking a Cow by Radio; the Milking Machine Attached to the Animal's Udder Is Being Operated by Radio Impulses

RADIO WAVES START MILKING MACHINE IN TEST

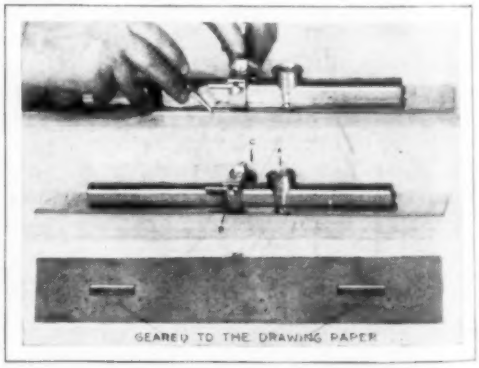
While the time has not yet come when the farmer can milk his cows by turning on his radio, a cow recently was milked by wireless control in a demonstration of a special milking machine. The radio milker operated five times as fast as the ordinary milking machine. The radio-control set was equipped with an aerial four and one-half feet long, and a similar aerial was hooked to the milking machine.

WIND TUNNEL MAKES ITS OWN FLYING WEATHER

Conditions encountered by an airplane flying through a winter storm can be created artificially in a refrigerated wind tunnel at Akron, Ohio, where full-scale airplane parts can be tested. Air is driven at speeds up to eighty-five miles an hour through an elliptical jet, eighteen by thirty-six inches in size. In the slow-speed end of the tunnel are 780 feet of ammonia piping, capable of reducing the air temperature to below zero. A series of water jets enables engineers to produce sleet in any quantity desired, thus creating, on the surface of a wing or other part, an inch of ice in less than two minutes. Study of the ice formation on exposed surfaces, and other low-temperature phenomena, is carried on through glass windows.

ROLLING RULER SAVES EYES AND TIME

Geared to the drawing paper with means for accurate spacing, or measuring of spaces, a rolling parallel ruler operates as accurately as a micrometer in gauging minute distances, and saves time and eyestrain in such work. When locked, the ruler lies rigidly on the paper, and for a great variety of work replaces the T-square, scale and dividers. It contains two dials, one on its face for reading comparatively long distances, and another attached to a worm gear on the side for small or micrometer spacings. By raising one end of the worm shaft, the worm is disengaged and the ruler can be moved any distance, the spacing being read on the face dial. When the worm is engaged, the ruler is ready for the final and more accurate work. The worm, when locked in position, serves as a brake to prevent the ruler from rolling off a sloping drawing board. For precision work, its accuracy is well within one one-thousandth of an inch.



Rolling Ruler Which Is in Effect an Accurate Micrometer; Measurements Are Shown on Dials

Down Safety Lane

Evanston Policeman Pasting "O.K." Sticker on Auto Windshield, Signifying That the Car's Brakes, Headlights and Other Accessories Are Safely and Correctly Adjusted

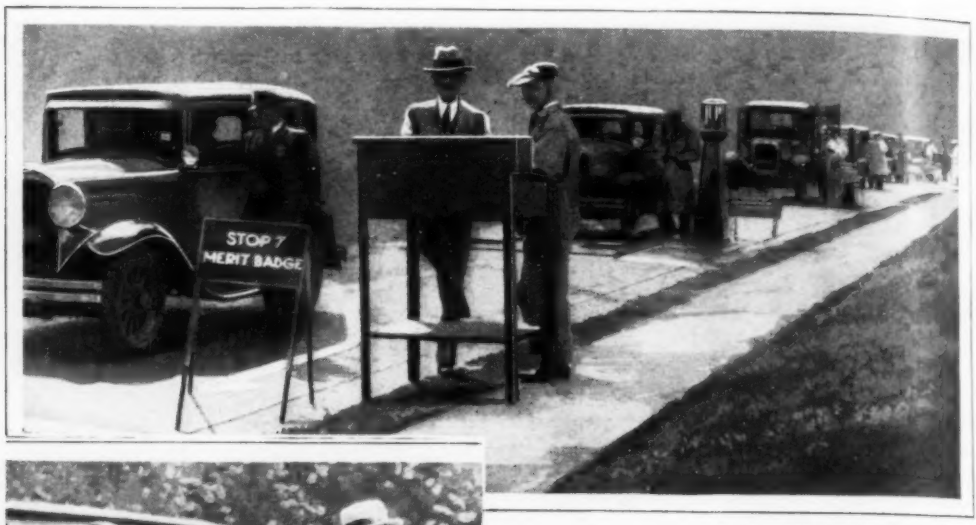
By PAUL D. PADDOCK

TO PROMOTE greater safety in motoring, a unique proving-ground service, to quickly and accurately check the condition of automobiles, is being introduced throughout the country. In a fifteen-minute free ride of a block or less, the driver gains information that may save him and others from injury or death.

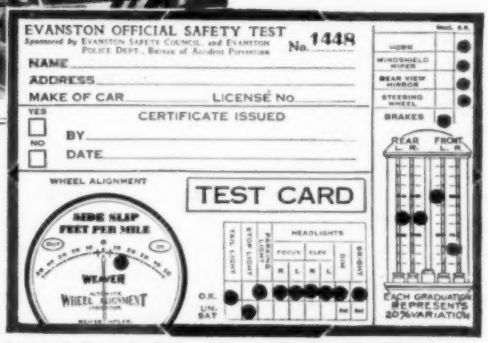
Maybe he thought his "bus" was in tip-top shape, but a little trip down "safety lane" convinces him that brakes, lights, steering wheel or other parts need attention. An astounding result of the examinations so far conducted shows that less than ten out of every hundred cars on the road are in satisfactory condition. Accurate tests indicate that nearly three-fourths of the more than 23,000,000 passenger cars and the 3,000,000 trucks in service in the country today are operated in a condition that invites accidents.

Safety lane is simply a program of easy but vital tests of car brakes and other equipment, developed from the recommendations of the American Automobile association and the National Safety council. The lane is set up in any convenient town or city street or in a service station. Tests are conducted under the auspices of police departments, safety organizations, chambers of commerce or associations of service men and, wherever given, are being eagerly taken. The public has received it as a sort of sporting proposition, and the fortunate car driver whose machine passes with a perfect grade is given a coveted "O.K." sticker.

At the entrance to safety lane, the car is registered, its owner's name and address, the make and license number being entered on a card issued in duplicate. At stop No. 2, check is made of tail, parking and stop lights. At the next halt, attendants wheel two headlight testers into



Courtesy Weaver Manufacturing Co.



Line of Cars in Safety Lane, Testing the Headlights, and Test Card Issued in Evanston; Punch Marks Indicate Findings

position and in a few seconds note if the lamps are correctly aimed and focused. Drive on, and at stop No. 4 is a gauge which tells if the wheels are in correct alinement, whether they turn in or out. This machine is accurate to the fraction of an inch. It tells a story that will help save the autoist useless wear on tires and the possibility of an accident. At this stop another little gauge is used to show if there is excessive play in the steering wheel.

A few feet on, and horn, windshield wiper and rear mirror are inspected; then comes one of the most important tests, that of the brakes. The car is driven upon a corrugated runway and at a signal from the attendant, the brakes are quickly applied. The results are indicated within a glass chamber on the brake-testing gauge. Four tubes of a red liquid are so adjusted that the red rises in each to a level corresponding to the effort put forth by each brake. If all four are equally adjusted the four columns of red will be at the same height.

Drivers of cars that need adjustments are advised to have the necessary corrections made at their service station and may return with their car for another trip through the lane. In many communities, police keep a record of all cars tested. In case a driver neglects having a necessary adjustment made and is involved in an accident later, the police have information that may be of aid in fixing the responsibility for the crash and the just punishment that should be imposed.

An extensive safety-lane campaign has been conducted recently in Evanston, Ill., in connection with that city's celebration

of a safety campaign that last year resulted in the reduction of fatal automobile accidents by more than sixty-two per cent, and the estimated saving of seven lives. More than 400 automobiles were tested daily. Only six to ten automobiles out of every hundred were found to be O.K. In some cases the safety-lane examinations were amplified by psychological tests on drivers who seemed to be incompetent to operate cars. These tests were conducted by the Northwestern University.

FAILING OIL FIELDS REVIVED BY ACTION OF WATER

The fact that oil and water do not readily mix has been turned to good purpose in some of the failing fields in New York and Pennsylvania where old wells have been made to flow again by flooding with water. The process is simple. Water is pumped into wells under pressure with the result that oil is forced through the sands into other wells that have been abandoned but have not been flooded. Oil so recovered is said to be of superior quality, and experts estimate that some of the wells thus treated will have a commercial life of thirty to fifty years in the future.

SCREW-CAP FRUIT JAR OPENER REMOVES LID EASILY

Loosening the screw-cap tops of fruit jars is made easy with an opener which operates automatically. It fits the tops of all jars and tightens its grip as greater leverage is applied. The same tool can be used to tighten the tops during canning.

¶Names and addresses of manufacturers of articles described in this magazine will be furnished free by our Bureau of Information.

Mechanical Tennis Partner, Consisting of Ball Attached by Elastic to an Adjustable Rod

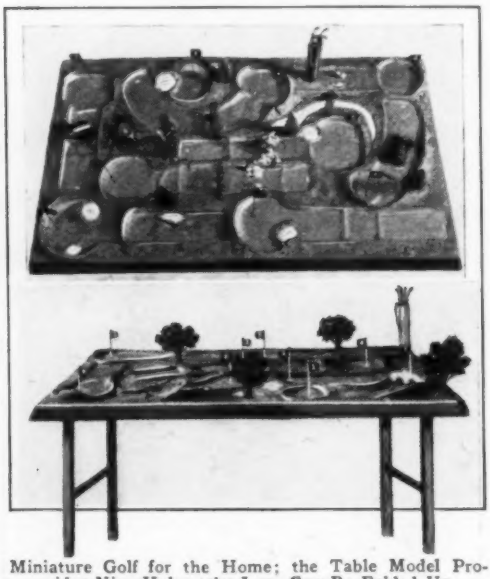
MECHANICAL TENNIS "PARTNER" PERMITS PRACTICE ALONE

To permit a tennis player to practice alone, a Frenchman has invented a mechanical "partner" for the courts. It consists of a light base on which is mounted a ball joint carrying a steel rod, to the end of which is attached an elastic cord fastened to a regulation tennis ball. The player strikes the ball in any desired direction, and it is returned by the elastic, bounces on the ground, and is again struck. The inclination of the rod can be adjusted by means of the ball joint in the base, so that all the fundamental strokes, drive, backhand or smash, can be practiced at will.

ONE-WAY TRAFFIC FOR PLANES FLYING OVER LONDON

Deciding that the sky streets above London are overcrowded, the air ministry has put into effect a one-way traffic system for airplanes to prevent the possibility of collisions in the air. Pilots flying between two airdromes only four miles apart, must go thirty-five miles under the new regulations. The flyers do not regard the orders with great enthusiasm.

NINE-HOLE TABLE GOLF COURSE GIVES THRILLS OF REAL GAME



Miniature Golf for the Home; the Table Model Provides Nine Holes; the Legs Can Be Folded Up

Set on sturdy legs, a table-size nine-hole golf course has been introduced. It is durably constructed of a synthetic wood and has enough hazards and opportunities for skillful shots with miniature clubs to satisfy lovers of the real game. Miniature trees add to the attractive appearance of the playing field. The legs fold and the course is over two feet wide and three and one-half feet long.

COLORED LIGHTS USED IN WAR AGAINST INSECTS

Colored lights are being used as the latest electrical weapon in protecting California's crops from insects. Color preferences of insects are tested with a device shaped like a wagon wheel, with eight long compartments arranged like spokes around a large central chamber. One end of each chamber opens into the central one, and the other end is fitted with an electric lamp and color screen, so that each can be flooded with a different color of light plainly visible in the central chamber. Thousands of insects of the same family are placed in the central chamber, and all compartments are lighted, each a different color. The insects enter the chamber having the greatest color attraction for them, and thus investigators are able to determine what colors certain insects like and which they shun. After such a test, two courses are open, the pests can be attracted by their favorite color and exterminated, or the color they avoid can be used to repel them from orchards or grain fields.

PNEUMONIA AID IS FOUND IN CRANBERRY BOGS

Scientists of the Rockefeller Institute for medical research are reported to have found a substance that promises protection against pneumonia in the cranberry bogs of New Jersey. The soil there yields a bacillus from which the substance is extracted. It attacks the outer coating of the pneumonia germ. Experiments on mice showed that the substance protected the animals from the disease and cured others which had been inoculated.

SERVICE STATION ON WHEELS AIDS NIGHT AUTOISTS

One Los Angeles youth is making money in his spare time by servicing the cars of motorists whose lights are not functioning properly. He has a motorcycle equipped with a service kit and a supply of auto lamp bulbs, and, at sundown, stations himself beside a busy boulevard. As soon as he detects a car with a dark bulb in head or tail light, he overhauls the driver, requests him to pull up to the curb, then offers to replace the bulb in a minute to avert possible arrest for the motorist. He averages from fifty to eighty dollars a week.

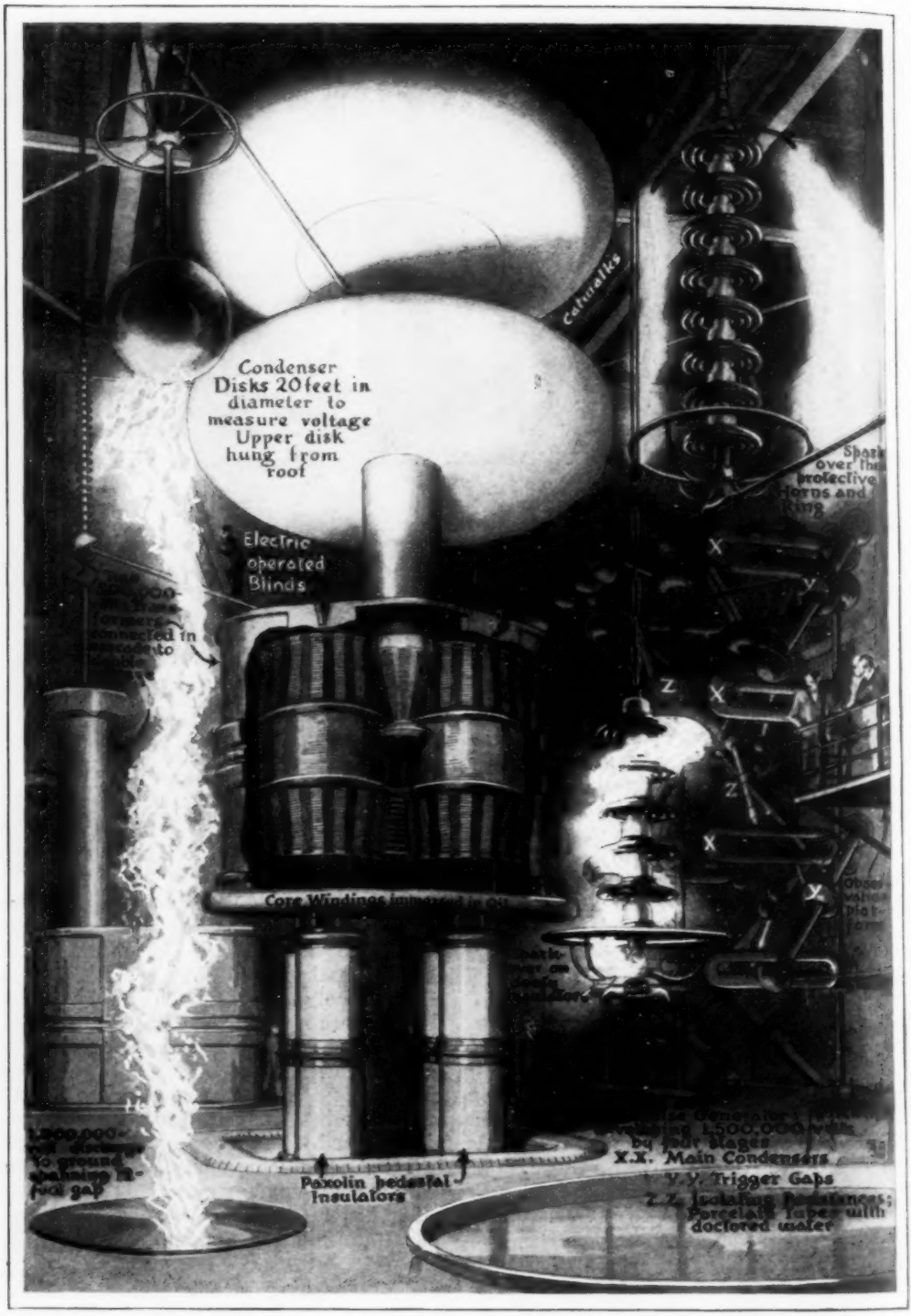
Motorcyclist Equipped with Supply of Auto Lamp Bulbs; He Makes Light Repairs at the Roadside

HOW HIGH UP DOES THE ATMOSPHERE EXTEND?

Exterior and **Interior Views of the Air-Tight Metal Gondola of a Free Balloon in Which Two Europeans Tried Unsuccessfully to Rise Ten Miles**

Existence of an atmosphere at an estimated height of 125 miles is indicated by observations of shooting stars. For about twenty miles up, the composition of the air is nearly the same as at the earth's surface, says Dr. W. J. Humphreys, of the weather bureau, except that the upper region contains little water vapor and less oxygen, although it is rather rich in ozone. The temperature is estimated at about sixty-five degrees below zero. At greater heights the atmosphere becomes richer in the lighter gases, and poorer in the heavier ones. At about fifty miles, the air is highly ionized, which is of vital importance to long-distance radio communication. Auroras stop at a height of about sixty miles, but extend out for about 400 miles and are electrical phenomena induced in some way by the sun. Science recently has been interested in the attempt of two Europeans, Prof. Auguste Piccard, Brussels university physicist, and an assistant, to explore the upper air. They intended to ascend 52,000 feet in a free balloon to which was attached an air-tight metal sphere as a gondola for the passengers, but failed in their initial effort when the balloon refused to leave the ground. The ten-mile ascension, for the purpose of studying cosmic rays, radio activity and the ionization of the earth's atmosphere, is to be tried again later, the first failure being attributed to bad weather conditions and the weight of the metal gondola, which is 220 pounds. This sphere is seven feet in diameter and contains, besides the many instruments used, an air-making machine to generate oxygen, and heating apparatus to counteract the low temperatures. The sphere also is fitted with an appliance to equalize inside and outside air pressures. The balloon has a capacity of 18,000 cubic yards of hydrogen gas, but is only partly inflated, the big bag expanding as it rises.

¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine.



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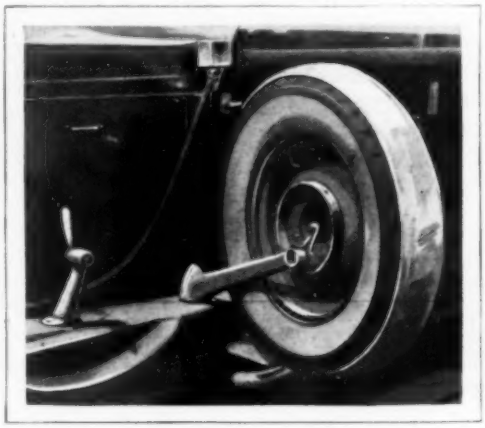
Artist's Drawing of Huge Generator and Apparatus Which Supplies Current Up to 2,000,000 Volts for Artificial Lightning Tests on High-Tension Line Insulators and Equipment in Manchester, England

LION ROARS AND COCK CROWS FROM CATHEDRAL TOWER

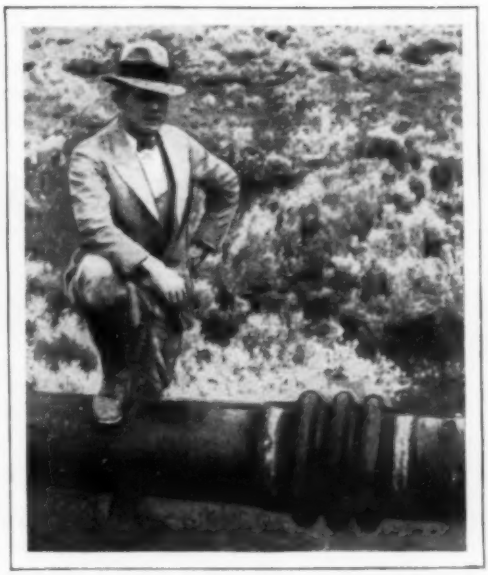
One of the most remarkable clocks in the world will be that to be mounted in a 140-foot tower forming part of the Messina cathedral, now being reconstructed after being devastated by the earthquake of 1908. At the top of the tower will be seen a bronze lion, twelve feet high, erect on its hindlegs, which are jointed. Between its front paws the animal will hold a banner with the arms of the city, and at midday the lion will wave the banner, lift up his head and roar as he lashes his tail. Under the lion will be a cock of bronze, eight feet high, which will crow to salute the dawn, noon and the hour of sunset. The lion stands between the figures of two women, representing legendary characters, who strike the hours of the day on sets of bells. When the lion finishes his noonday roar, a scene is enacted below him, an angel bearing a scroll to the Virgin and being replaced by Saint Paul and four ambassadors who take away the scroll. Underneath this scene is another representing the seasons of the year with the figures in motion.

SPARE TIRE ON SWINGING ARM GIVES ACCESS TO ENGINE

To provide easy access to the engine and for speedy demounting, a spare-wheel carrier set on a swinging arm is adaptable to production-made cars. The carrier consists of the swinging arm fitted to the wheel carrier at the outer end and housed over a swiveling cap joint. Wheel lugs are screwed into a faceplate mounted on the carrier arm. A coiled spring pushes the mounting and the wheel and tire away from the hood when a special lock is released, the spring lifting the entire assembly free of the indented well in the frame or fender, and pushing it out of the way.



Swinging Arm for Spare Wheel, Which Turns Automatically to Give Access to the Engine



Corrugated-Steel Expansion Joint for Pipe Line, Which Allows It to Contract or Expand

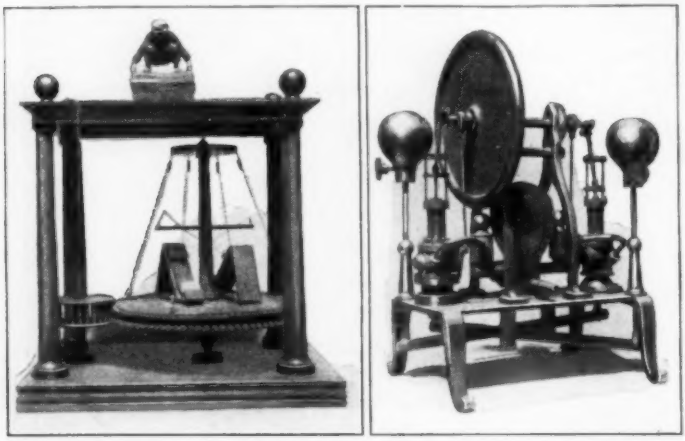
PIPE LINES ARE PROTECTED WITH EXPANSION JOINT

To overcome the tendency of large pipe lines to part or buckle from expansion and contraction, a corrugated steel expansion joint is used with the electric-arc all welded pipe. The joint is of rolled sheet steel with three large corrugations, one joint being used for each 300 feet of pipe. Each joint allows from three to four inches of contraction or expansion. Improved machinery is speeding up the laying of these large lines. One construction unit comprises a gasoline-operated wheel digger which opens one and one-quarter miles of trench a day, a tractor equipped with winch and steel boom for pipe laying, two dynamos to supply current for welding and several smaller tractors for speeding up the work.

¶Ten cents worth of electricity will do a man's work for a day.

WORLD'S GREATEST HOAX RECALLED BY MODELS

Tucked away in the museum of the Franklin Institute in Philadelphia are two innocent-looking models, yet one of these



Models of Two "Perpetual-Motion" Machines That Deceived Hundreds; One Was Operated by a Hidden Boy, the Other by Compressed Air

was sufficient to cause the legislature of Pennsylvania to pass an act authorizing the appointment of a committee to look into the possibilities of the invention, while the other was responsible for losses to investors estimated in the millions. The first was the invention of Charles Readhefer, for which he claimed the power of self-motion. The inventor was subtle in his argument, and even today it must be read twice before its lack of logic is perceived. "A loaded wagon will run down hill," he reasoned. "If a hill is steep enough, and the hill is capable of moving out from under the loaded wagon, then if the wagon is prevented from moving except in a vertical direction, it will push the hill from under it." This much seems clear and obvious, but now comes the hitch. "Now in this so-called perpetual-motion machine there are two hills or inclined planes mounted on opposite sides of a wheel, which wheel is horizontal and its axis vertical. There are loaded wagons on the inclined planes, and as the wagons cannot go down the planes, but are held by a complicated system of levers, and the planes cannot move from under the wagons, therefore, the effort to do what both are prevented from doing results in a constant push and the wheel is driven around by this power." Suffice it to say that the learned committee appointed by the legislature after long and baffling study found that Mr. Readhefer's machine was really operated by a small boy turning a crank in a room below that in which the experiment was made. Mr. Readhefer retired into oblivion and the model found its way into the Franklin Institute.

Years later, John W. Keeley began to attract attention with a device which he claimed was operated by a force hitherto unknown to science, and capitalists became interested in the contraption which was to derive its power from the disintegration of a few drops of water. The Keeley Motor company was organized with a capital of $5,000,000. Unlike most inventors, Keeley had no education whatever, but was a very forceful speaker. Nothing much came of this project and what happened to the money will always remain a mystery. Undismayed, Keeley later announced the invention of a hydro-vacuo engine, using a vacuum in connection with water pressure. Scientists examined the machine, one part of which had what Keeley claimed was a wire attached to it. During the examination this "wire" was cut and found to be a hollow tube. The mystery was solved, since this tube carried compressed air.

ELECTRIC HEATER WITH A FAN GIVES WARM OR COOL AIR

Warm air in winter and cool air in summer is circulated by an electric heating appliance consisting essentially of a heating element with radiator cast in one aluminum unit, behind which

are mounted the motor and fan, the unit being contained in a small cylindrical case available in different colors. It directs either warm or cool air to the point where needed, the fan operating independently of the heater to furnish a supply of cool air in summer.

AIRPLANES ROUT WILD HORSES

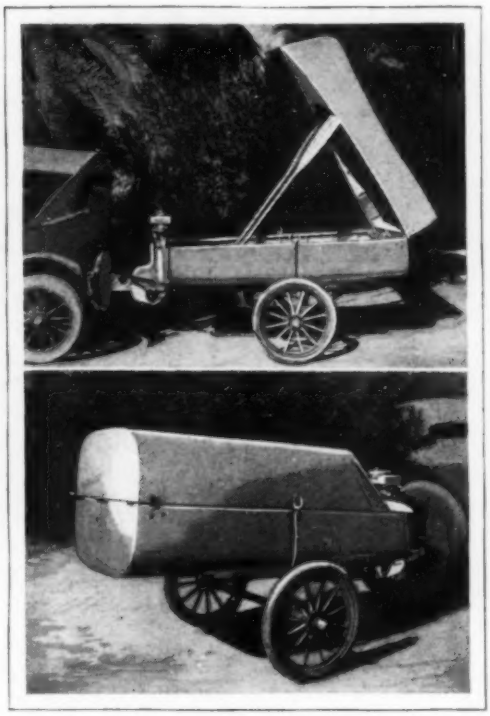
Airplanes were used recently to frighten wild horses from canyons and thickets in eastern Oregon. By swooping from windward toward the animals, they were scared and routed, and cowboys thus corraled 1,000 of them. These horses, once in demand in the west, have had their usefulness destroyed by the automobile, and now are considered a nuisance by ranchers of several states. Hence they are rounded up and the carcasses are sent to Europe, where the meat is in demand.

COIN-IN-THE-SLOT BASKETBALL PLAYED LIKE REAL GAME

Basketball now has joined the list of sports played by slot machine. The coin-in-the-slot game is competitive and is played by two persons. It consists of an inclosed court with two goals. The ball always rolls into small depressions in the

Slot-Machine Basketball Game That Requires Skill; Levers Flip the Ball Toward the Baskets

court. Two levers, one manipulated by each player, control the ball's movements, flipping the lever when the ball rests in a depression and causing it to jump toward a basket. The levers, however, are so arranged that varying pressure is required to shoot the ball from different points, thus requiring skill and training.



Two Views of Folding Boat on Auto Trailer; When Folded, It Provides Space for Baggage

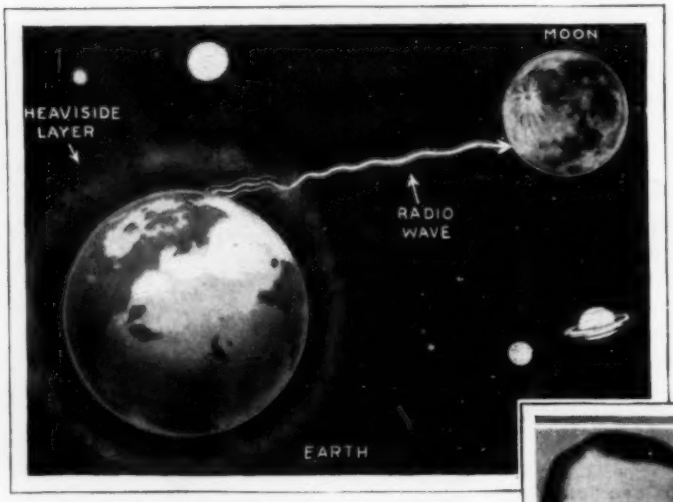
FOLDING BOAT EASILY CARRIED ON AUTO TRAILER

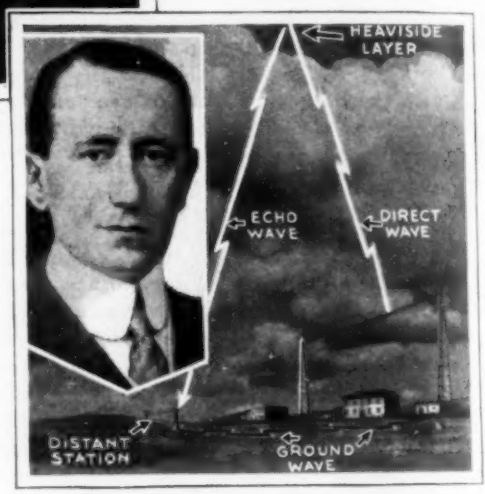
For the tourist or vacationist who seeks the water, a folding boat and trailer for transporting it provide an easy means of taking the boat on a trip with the car, the boat also offering a commodious space for luggage en route. The boat, when folded, occupies no more space than the ordinary trailer, and is a seaworthy craft in the water, being adaptable to sails, oars, inboard or outboard motors, or to a combination of these powers.

MAILBAGS GIVE THEFT ALARM IF STOLEN IN TRANSIT

Mailbags that give audible and visible warnings when anyone attempts to tamper with them are being used in England to frustrate theft of pouches. The bags are strapped to a platform of compressed springs connected to the electrically operated alarm system. An attempt to loosen the straps or dislodge the bags completes a circuit, setting off a siren and lighting a red lamp in the driver's compartment.

HOW HEAVENS MAY BE EXPLORED BY RADIO BEAMS





Drawing Showing How Marconi Believes Beam Waves May Travel to the Moon; Right, Path of Ordinary Radio Waves, and Insert of Marconi

Radio waves of the beam type may be used to explore the outer reaches of space for millions of miles and solve some of the secrets of the universe. Guglielmo Marconi, known as the father of radio, in a recent address in Italy expressed the belief that the beam waves travel far beyond the layer of air surrounding the earth, thus differing from the two kinds of radio waves that are purely terrestrial—the ground wave that follows the surface of the earth, and the echo wave that leaps to the "Heaviside layer" of ionized air some 100 miles above the earth. It is now believed that the beam wave can travel in a straight line and penetrate the ionized layer of air and then continue on into space. Just how far such waves go is purely conjectural, but some estimates are from 25,000,000 to 48,000,000 miles. This is a comparatively short range, when judged by distances in the universe, but it would reach many heavenly bodies that are near neighbors of the earth.

ELECTRIC EYE SORTS METALS BY LIGHT REFLECTIONS

Saving of valuable minerals and metals of industry now wasted may be possible through the use of a photo-electric cell, or electric eye, to separate and sort them. Prof. Roy W. Drier, of the Michigan College of Mining and Technology, has made an experimental apparatus that thus classifies metals by providing for particles of the material under test to fall upon a moving, black, endless belt. They pass under a constant source of light, a part of which is reflected back to a photo-electric cell by the material itself. Some particles reflect more light than others and thus set up different currents through the cell, these currents being amplified to operate a mechanism that removes the metal whose reflection index is either above or below a certain value.

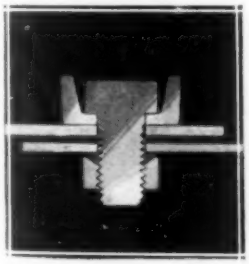
POWER-LINE LEAKS DETECTED BY AIRPLANE PATROL

Airplanes flying over electric transmission lines can detect power leaks by using a special form of trouble locator now employed by one St. Louis power company. The planes fly low over the lines, and the apparatus not only detects a leak instantly, but shows at which tower it is to be found so repair can be made at once.

This enables one plane to patrol long distances and it is now proposed that the ship also carry repair parts ready to be dropped overboard where a leak is found. In an emergency a repair crew would also be carried in the plane and sent down in parachutes at the point where the trouble was detected.

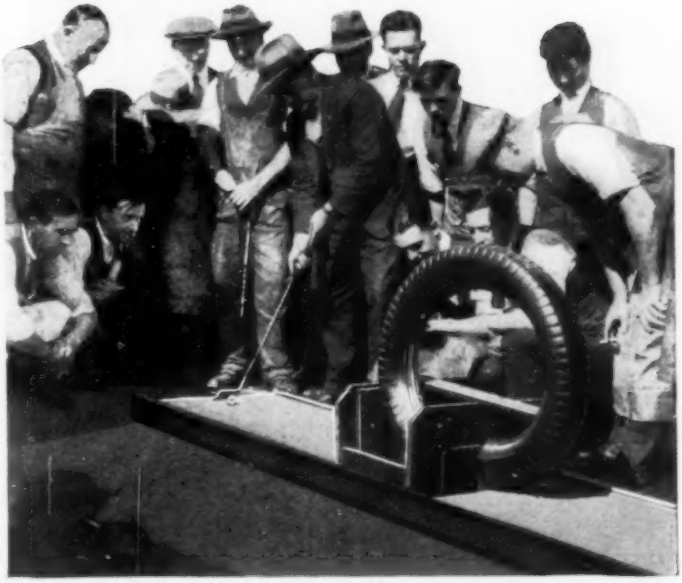
LEAK-PROOF NUT AIDS STORAGE OF FLUIDS

Problems of storing liquids in bolted tanks have been greatly simplified by the use of a leak-proof nut that makes such tanks available for storing and transporting many more liquids than have been thus carried heretofore. Instead of depending on the ragged edges of packing torn by the bolt as it was driven through to make it leak-proof, the latest method utilizes a recessed nut and gasket and a machine-punched hole for the bolt. The gasket is placed over the bolt on the outside, and the recessed nut presses over it firmly when tightened. Many types of packing and gaskets can be used, depending on the nature of the liquid to be stored, and it is unnecessary to retighten bolts after they have been once put in place.



OLD AUTO TIRE IS GOLF HAZARD ON MINIATURE COURSE

Miniature golf-course designers are taxing their ingenuity to provide difficult and unusual hazards for the players as the game becomes more popular, and one English course has an old automobile tire standing on end to harry the golfer. He is expected to shoot his ball against the inner rim of the tire, and if his aim is right, the pellet travels around the inside of the rim and drops into a hole.



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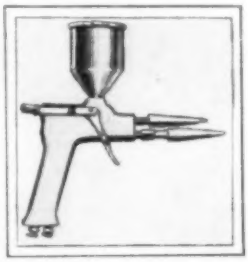
Automobile-Tire Hazard on Miniature Golf Course; the Ball Is Expected to Follow the Inside of the Rim and Drop into a Hole Below

SPRAY GUN FOR METAL TINNING ELIMINATES USE OF ACID

Tinning of all common metal surfaces can be accomplished without the use of acid by applying a tinning compound with a spray gun which is a combination of air nozzle and gas flame. As the metal surface is heated, the compound is released by trigger action, and the flow regulated according to the need. Corrosion and rust caused by the use of acids are prevented, and the operator is not subjected to the harmful fumes as the material used is free from any injurious substances. It speeds up the work in auto-body and fender-repair shops, and also is used in tinning bearings for babbitting and in the repair of cracked cylinder blocks.



Making Home Tasks

This Kitchen Cabinet Has Dining Table That Slides Out as Shown, Besides the Regular Porcelain Work Top; There Are Two Drawers for Silverware and an Electric Outlet for the Percolator or the Toaster

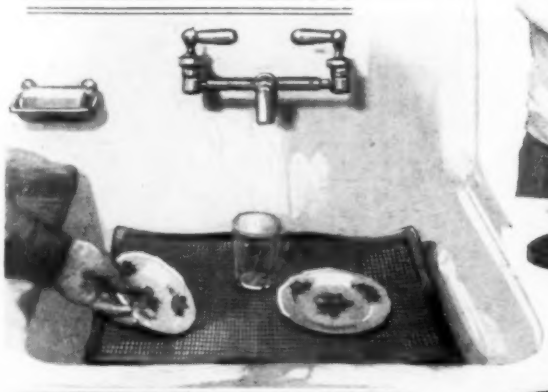
At Left, Wire Holder Saves Time and Work in Boiling Eggs and, Below, Handy Clamp for Lifting Pots and Pans from Stove

Above, Water Heater for Homes without Gas Is Operated with Fuel Alcohol Which Is Quickly Converted into an Odorless and Smokeless Flame; It Is Said to Be Absolutely Safe, Not Expensive and Is Always Ready for Service

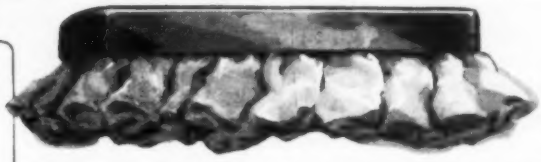
a Pleasure

Electric-Light Stove Cooks Whole Meal at Once and Uses Little Current

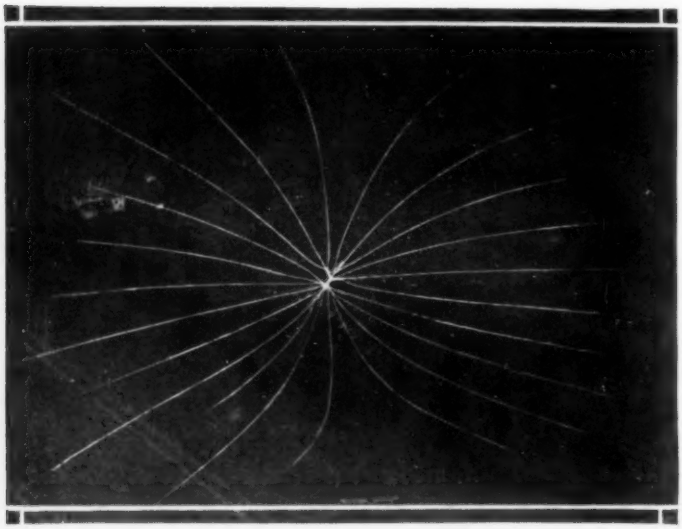
Pillow Tops and Other Coverings Easily Removed When Adjusted with Interlocking Fasteners



Above, Hat Brush and Holder in One; Below, Polisher of Chamois Cloths



Rubber Mat for Sink Protects Dishes from Breaking; the Cords Imbedded in Fabric Swell, Affording a Gripping Surface for Slippery, Soap-Covered Articles; It Is Easily Cleaned and Also Protects the Sink



Picture of a Lightning Flash Taken from an Airplane; Note the Converging Positive and Negative Charges and the Connecting Line

PICTURE OF LIGHTNING FLASH TAKEN FROM AIRPLANE

One of the most unusual pictures of a flash of lightning ever recorded was obtained recently by a photographer for a Dallas newspaper who snapped a photograph of a bolt of lightning from an airplane as the electrical discharge took place below the ship and almost directly under it. The photographer was taking pictures of a flying field when a thunder shower came up, and the flash occurred just as he snapped his camera for a shot of the field. When developed, the plate appeared to have been overexposed, and looked as if shattered by a blow near the center. It was not broken, however, the illusion being only in the exposed sensitized covering. It showed white lines starting from a score of points near the four edges of the plate, all converging toward a point near the center, and growing heavier as they converged. Close examination showed thirteen lines joined in one large white spot, and nine converged at another spot, the spots being connected by a heavier line. Scientists said each line represented an electric charge, some converging into one larger charge of positive form, and the others of negative potential. The jumping of a spark across the gap between these built-up charges represented the lightning, shown by the one heavy white mark. Beyond the lightning flash, the plate showed the ground scene.

BUMPER FOR AUTO SAVES LIVES OF PEDESTRIANS

Life-saving automobile bumpers which scoop up pedestrians run down by cars recently were demonstrated before a group of automotive engineers. The bumper, intended to save the victim of an accident from injury or death, is attached to the front of the car like the ordinary one except in case of an accident. When an accident is imminent, the driver releases the bumper by pressing a pedal in the floor. This causes the bumper to drop down and open a padded shield which extends from the top of the radiator, in order to catch the victim in the pad at the moment the auto hits him.

Life-Saving Auto Bumper Which Drops When the Driver Presses a Pedal and Scoops Up the Accident Victim

SINGING OF FOREST IS EXPLAINED BY AIR CURRENTS

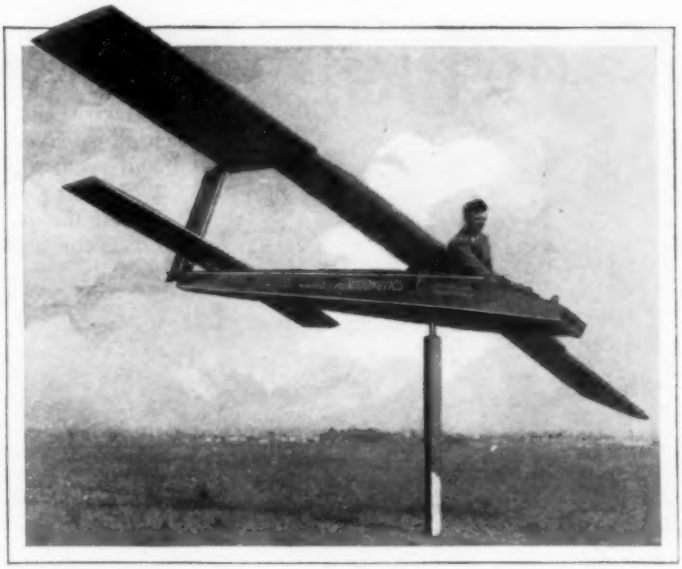
In a large forest in France, during calm summer days when the verdure is the seat of rapid evaporation, a harmonious sound is often heard which has caused the peasants to refer to the woods as a singing forest, and to look upon the phenomenon as something supernatural. The harmonic sounds are produced by air currents set up in the forest itself, the effect being similar in a way to the vibrations of a vast aeolian harp. Musical sounds also have been heard rising from some forests in England, particularly by the occupants of balloons drifting overhead on a calm day.

RUBBER DOUGH ENDS SQUEAKS IN AUTOMOBILE BODIES

Rubber dough, a plastic material, is being employed in the assembly of automobile bodies, to make them quiet originally and to prevent the little squeaks that most bodies develop after a period of use. In its original state, the rubber dough is a comparatively free-flowing liquid, and when applied to wood or metal body parts, spreads evenly over the surface. Then, when the body goes through the paint ovens, the rubber solution expands to fill every hollow and crevice and form a cushion of soft rubber between surfaces. It remains soft during the life of the body. It also is employed as an insulator of sound, retarding the transmission of noise from one part of the structure to another.

GLIDER ON BALL-BEARING POST TRAINS STUDENT FLYERS

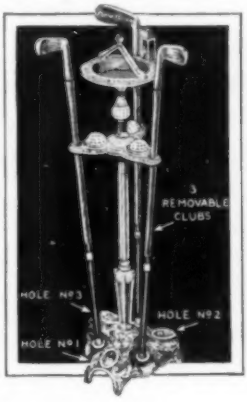
Student flyers are able to master the first principles of controlling an airplane or sail plane without danger of accident to themselves or their ship by using a type of ground plane recently introduced in Los Angeles. This ship for beginners is a glider of regulation size, mounted on a post with ball-bearing top. It has all the controls of a free glider and the student can do anything in it that he can do in a sail plane in flight. After mastering the controls, the beginner is blindfolded, and his reactions to the motions of the glider determine his progress.



Glider Mounted on Post with Ball-Bearing Top, Which the Student Can Control Like a Real Ship without Fear of Accident

GOLF SET FOR PARLOR PUTTING COMBINED WITH ASH TRAY

For those who like to practice golf at home, even in bad weather, a parlor golf-tree set now is available. It combines a golf putting stand with an ash tray. The metal stand is three feet high, and contains spaces for three putters, which are part of the equipment, and three golf balls. In the base of the stand are three holes serving as targets for the balls, thus making of the set a complete miniature golf course, if the rug is used for the green.



Camera Actuated by Time Clock, Which Takes Pictures of Smoking Chimney at Minute Intervals

PHOTOGRAPHIC SMOKE FINDER WORKS WITH TIME CLOCK

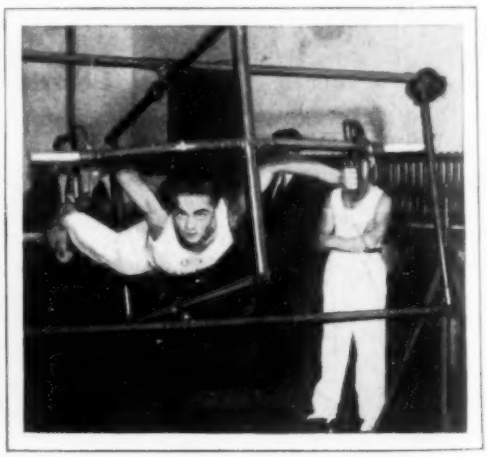
Detecting violations of city smoke-abatement regulations, and making a permanent record of them, is the purpose of a photographic smoke finder used in St. Louis. The instrument consists of a specially constructed camera, combined with an electric time-clock arrangement that takes photographic exposures automatically, once a minute, for a period of four hours. The resulting film shows how much smoke any chimney emits and for how long a period. Strips of the film are sent to violators of smoke laws with requests that they take steps to remedy conditions. The film, besides depicting the amount of smoke being emitted, also shows its density.

MUSIC MADE BY ELECTRICITY TO SURPASS PRESENT KIND

Electrons, which can be made to whistle like a piccolo, roll like a drum, or imitate the human voice, are destined to give free rein to the imaginative musician of the future. Dr. A. N. Goldsmith, vice-president of the Radio Corporation of America, believes electricity can produce tone effects never heard before, and open an entirely new field of musical interpretation. Music of the past has been produced mechanically, but that of the future will depend on electrical vibrations corresponding to musical tones of any desired quality or timbre, and produced by coils of wire and vacuum tubes linked with loud speakers. Hammers, strings, pipes and reeds are limited in scope and possibilities as compared with electrically produced music, which in no way will displace the artist but give the musician an even wider scope, Doctor Goldsmith believes. The control of alternating current to produce notes and sequences of notes will not depend for volume on the physical strength of the performer, and the mode of control can be almost anything desired, keyboard, string, fret-board, or merely waving the hand. By electrical means, any tone quality capable of perception by the human ear will be obtainable. This will enable the imitation of any instrument now known, and the production of tonal effects never before heard, for any desired pitch or volume is possible. Doctor Goldsmith adds, however, that the development of such music will be a task of many generations.

BODY SWINGS IN THE FRAME OF QUEER EXERCISER

Permitting the body to assume an unusually large number of positions, an exercise frame somewhat resembling a gyroscope in principle is used by a gymnasium instructor in Vienna. It consists of an upright support to which are attached two revolving frames, one within the other.



Gyroscopic Exercise Apparatus, Consisting of Two Revolving Frames, One within the Other

Raising the "Hindenburg"

Covered with Seaweed and Barnacles, the Huge Hull of the "Hindenburg," Scuttled at Scapa Flow, Is Here Partly Raised during the First Attempt to Salvage Her

By HAROLD T. WILKINS

THE lives of 240 men, working night and day with a battery of fifteen electric and five oil pumps, and a stake of $1,175,000, have recently been risked in an attempt to tear out of the clutches of Davy Jones the prize of 28,000 tons of valuable iron and steel and non-ferrous metals represented by the barnacled hull of the former German dreadnought battleship "Hindenburg" which, for eleven years, has been lying in a forest of seaweed at Scapa Flow, Britain's war-time naval base.

After six and a half years' expenditure of human effort, backed up by the latest appliances known to the science of salvage, Davy Jones has been beaten, and the weed-swathed, sea-stained battleship has been raised to the surface, and made fast, till she can be towed to the shipbreakers' yard, where she will be reduced to scrap. The story of the fight with the sea for the possession of these thousands of tons of scrap metal is a thrilling one.

Four attempts had been made to raise the "Hindenburg" far enough above the water on an even keel, so as to tow her up the sound and beach her where the wreckers could break her up for the valuable scrap. Great rents in her hull had been patched up, her port covers screwed home, and her valves and pipes plugged with concrete and wood; and then it was found that she sunk deeper in the ooze of the sea bed, while tons of mud had seeped through the ports into her interior. Divers went down, unscrewed the porthole covers and blew a powerful jet of water onto the mud, so as to eject it from the hull.

Tugs then towed into position over the sunken battleship two great floating docks or pontoons, which had been made by cutting in two a huge cylindrical floating and submersible dock, 400 feet long by 130 feet wide, surrendered by the Germans at the end of the World War. By a strange irony of fate, this great dock, intended by the Germans to receive and test their war-time U-boats, has now been converted into pontoons to lift the sunken German high-seas fleet from the waters of Scapa Flow.

The pontoons were moored on each side of the sunken warship, while divers went down to pass heavy steel cables under the

the bottom. Nothing for it, but to reflood her and send her back to the sea bed, while despairing salvors calculated their six months' loss of work, night and day, of 200 men.

Followed two other attempts in succeeding years—Davy Jones allowing a few months in the summer of each year when winds and waters are calm enough for work to be done—and the stake was doubled, until the anxious salvors were faced with the prospect of great loss, or the alternative of moderate profit, if luck sided with them at the turn of the gamble with the sea. If the salvage firm decided at the eleventh hour to withdraw from the game and "cut its losses," certain ruin would follow. The men had gone too far to back out of the venture.

The "Hindenburg's" bridge and hull, both ends of the cables being reeved round blocks and winches on the pontoons' decks. Now, tricky Davy Jones took a hand in the affair. A gale blew in from the Atlantic, and squalls of rain drenched the salvors while they watched breathlessly the timbers of the upper deck creep minute by minute above the water till the guns, barnacled and trailing seaweed, emerged, and a diver nailed the red ensign to the "Hindenburg's" flag staff.

Courtesy Sport and General

Above, Looking Down on the Deck from a Gun Turret, and, Below, Stopping a Leak in One of the Cabins

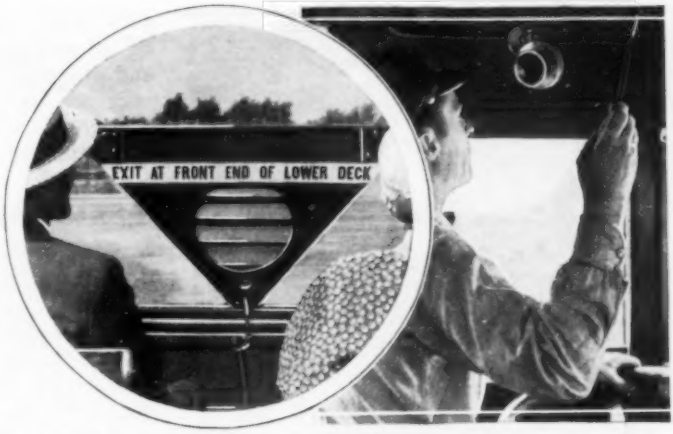
The prize was in the salvors' grasp and men shook each other by the hand, while the pumps were working at top speed expelling 10,000 tons of water an hour from the hull of the "Hindenburg"—when she was seen to list. Slowly, she heeled over to an angle of thirty degrees, threatening death if she toppled over and plunged to remaining funnel stood just above high-water mark, and under her stern to port the salvors laid down a great bed of submarine concrete, weighing more than 600 tons. Poking above the water over the stern of the "Hindenburg" was a steel shaft, like a chimney, inside which was located an underwater pumping station. When the pumps got to work at the bow end of the sunken ship, the expelled water

lightened the hull, so that the stern pivoted around and had a tendency to pull the warship over on to her side. This tendency the salvors sought to counteract by the installation of the pump in the steel chimney shaft and the concrete bed to the port or left side of her stern. The divers could not make the sunken warship water-tight, and there was a constant battle going on between the pumps expelling the water under strong jets of compressed air, and the leaks letting the sea back into the ship.

Battle was joined with Davy Jones at high tide exactly eleven years after the ship had been sunk. Once more the hull emerged and all seemed going well, till, just at high-water mark when the tide was exerting its full effect in buoying up the "Hindenburg," she heeled over dangerously, and Mr. Cox, the salvors' president, watching with tense, white face, the issue of the long fight, reluctantly ordered the divers to quit the warship and the pumps to stop.

"We must postpone the attempt to raise the 'Hindenburg' till we have built another concrete bed, this time on the starboard or right side of her hull," he told Popular Mechanics Magazine's representative. "I reckon it will take two or three weeks for the concrete to harden enough and that the next round will be the last, and we shall have beaten Davy Jones' locker."

Exactly thirty-one days later, the second bed of concrete had hardened sufficiently to stand the terrific weight of the "Hindenburg's" hull, and then the pumps were again started and began to pour out fifty tons of water each minute from the submerged ship. In the evening, a diver went down and reported that the "Hindenburg" was rising clear of the bottom. Bit by bit, she floated nearer the surface, rising at the rate of six to seven inches every fifteen minutes, till, by midnight, her after turrets were clear of the water, and a flag was flying at the mast four feet above the surface of the sea, at her stern.



Loud Speaker on Upper Deck of Motor Coach, and Driver Calling Streets for His Passengers

LOUD SPEAKER ON UPPER DECK OF CITY MOTOR COACH

For the benefit of passengers occupying the upper decks of Chicago motor coaches, these busses have been equipped with loud speakers and a system of light signals operated by the driver. The coaches are operated by one man who serves as driver and collector. He speaks into the microphone to announce streets and danger points to the upper-deck patrons, and pulls a cord which causes a red light to flash as a warning to his passengers to remain seated when the bus approaches a viaduct or low bridge.

SPRAYING UNDER THE LEAVES KEEPS INSECTS AWAY

To water and spray potted plants, a small sprayer which has the advantage of reaching under leaves where parasites lurk, is now offered. It resembles somewhat a lemon squeezer with handles to exert pressure. At one end of the handles is a perforated bulb which contains the liquid, and pressure on the handles forces an oval plunger into contact with the bulb, causing the liquid to be expelled in the form of a fine spray.

One of the Latest Aids to the Golf Player, a Gauge That Registers Distance and Quality of Shots

GOLF-STROKE GAUGE HELPS PLAYER IMPROVE GAME

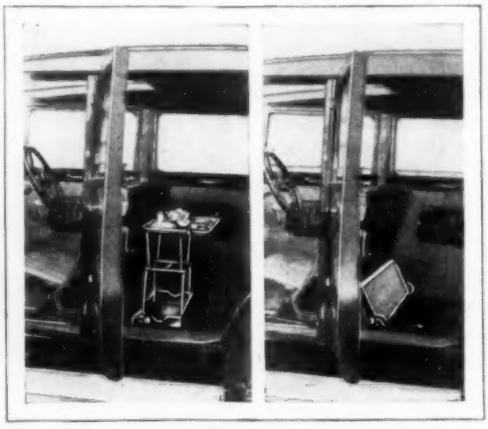
For outdoor or indoor use, a golf-stroke registering gauge now on the market tells the player how far the ball would have gone from the tee, shows if the shot was hooked or sliced and gives other helpful information to aid the player in constructive practice. The instrument rests on the ground or floor without fastenings, weighs seventeen pounds, has a rubber-tired base and is so arranged that the ball is screwed tightly to a projecting arm which rotates on a ball-bearing axle. Yardage is indicated at once on a meter opening at the top. If the ball is topped or lofted, the fact is indicated immediately in small openings on the right side while hooks and slices are registered in the same way at the left. The arm is strongly constructed of steel and is balanced with mercury, while the entire mechanism rotates on an axle also, to help absorb the shock and improve the "feel." The gauge is accurate, easy to use and is intended especially for home or office use during days when play outdoors is not practical.

FLAME AND WATERPROOFING AGENT FOR WOOD

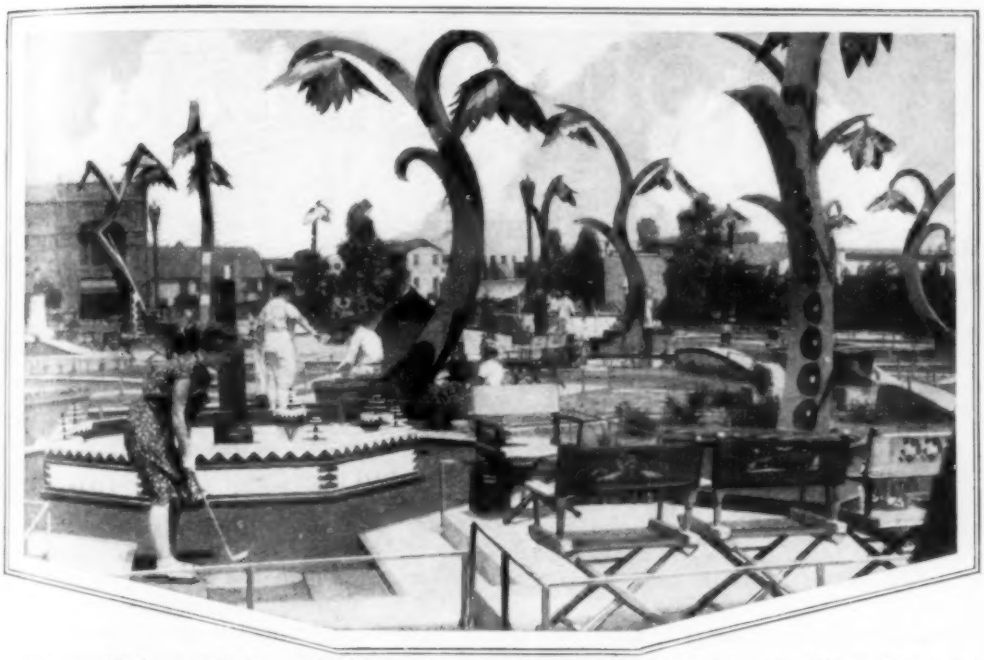
Fire and waterproofing of woods and textiles is expected to be greatly simplified through the recent development of a series of products under the general name of "arclor," which is a derivative of the chemical compound diphenyl, a milky-colored substance made by uniting two benzine molecules. By adding chlorine in various amounts to this chemical the new series is obtained, ranging in variety from a watery substance to a light amber-colored solid. Commercially, the compound is expected to be used for protective coatings, water and flame-proofing, molding, electrical insulation, adhesives, printing inks, artificial leather, leather finishing, textile finishing, sealing waxes and chewing gum. It is more expensive when used for fireproofing wood than when common mineral salts are used, but it does not leave the wood brittle and lifeless, causing it instead to gain in strength and become a superior product.

FOOTREST AND FOLDING TABLE FOR THE AUTOMOBILE

Converting the automobile into a tea room for a quick lunch is made possible by a folding table which, when not in use, serves as a footrest for passengers in the rear seat. The interior fitting is attached to the floor of the car, and, when folded, rests at an angle to provide an excellent rest for the feet. When used as a table, the base is turned against the floor and the legs are extended to support the top.



Collapsible Tea Table for the Auto, Which, When Folded, Is Converted into a Footrest



Elaborate Miniature Golf Course Carried Out in Modernistic French Design; One of the Unusual Features Is a Large Lake and Lily Pond with Underwater Illumination at Night

POOL IS COMBINED WITH GOLF ON BARNYARD COURSE

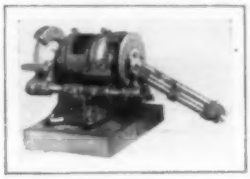
A California miniature golf course which has been made for the private use of a moving-picture actress, is carried out in a modernistic French design. It has a large lake and lily pond with underwater illumination, and artistic bridges and effects, all of the modernistic trend. Among the unusual decorative effects are a number of huge artificial plants. As a variation of miniature golf, a pasture-pool or barnyard-golf course has been opened in Los Angeles. The hazards are made up of various barnyard animals which squawk, moo or quack in realistic fashion when the ball rolls down their throats to the green. The game combines pool and golf, the handle of the putter being used like a billiard cue in teeing off.

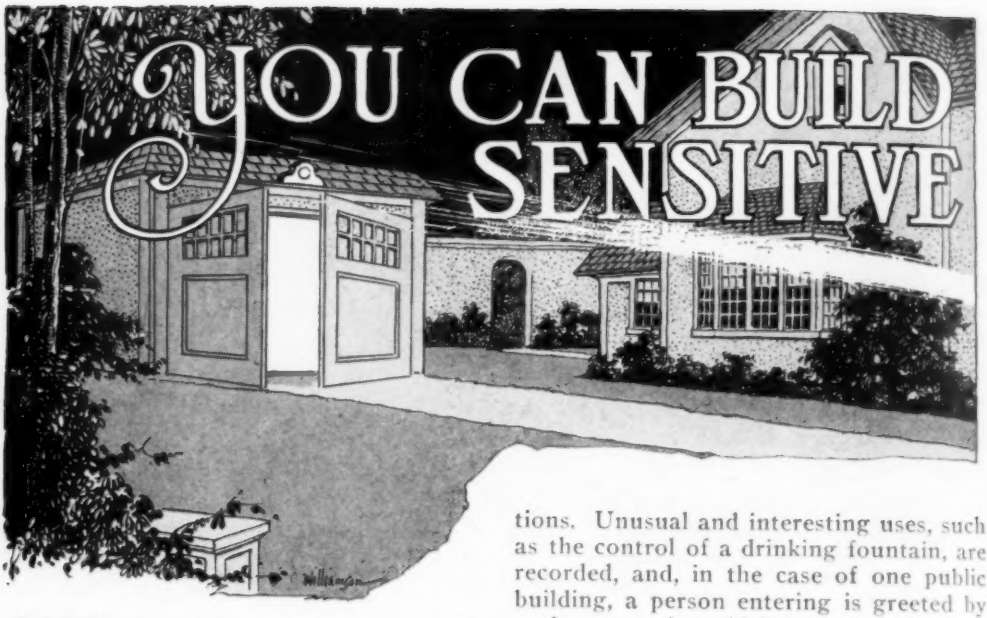
PAPER FROM SEAWEEDS

Seaweed is being used for the manufacture of several grades of paper by a process evolved by a Russian engineer. By means of machinery especially constructed for using seaweed, this material can be converted into paper in less than half an hour, and at remarkably low cost, at a factory in Siberia. Sixteen kinds of paper, as well as cardboard and glue, have been obtained, and the principal by-product is a fireproof substance that can be made into tile.

DRILL SHARPENER IS ATTACHED TO A BENCH GRINDER

For use with a six-inch bench grinder, an inexpensive drill-sharpening attachment now is being offered. It will grind all two-lip drills from the smallest up to thirteen-sixteenths of an inch in diameter. The adjustments for varying diameter and clearance are made easily, and no mechanical skill is required to operate it. The grinder is mounted on ball bearings and the abrasive wheels are balanced to remove vibration. The machine does accurately and almost automatically what heretofore has been done in haphazard fashion, resulting in drill breakage, waste of power and poor workmanship.





YOU CAN BUILD SENSITIVE

ALTHOUGH this relay is very simple, its application is extremely valuable. It has been adapted to various methods of train control, burglar alarms, automatic machinery, color sorting, counting moving objects and numerous other applications. Unusual and interesting uses, such as the control of a drinking fountain, are recorded, and, in the case of one public building, a person entering is greeted by a pleasant voice which says, "good morning, please sign the register and pass on"; a light-sensitive relay and an electrically operated phonograph do the trick. A garage can be lighted and the doors opened merely by directing the beam of a spotlight upon the light-sensitive relay as the car comes up the drive. All that is necessary in this case is the relay and an electrically driven device for opening the doors.

The relay consists of a light-sensitive cell, more commonly known as a photo-electric cell. This cell converts light rays, when directed through its window, into electrical current. The current from the cell is then applied to the input of a vacuum tube and amplified several hundred times. In the output circuit of the vacuum tube is connected a small, sensitive current relay, which is thus operated indirectly by light applied to the photo-electric cell.

You will note that the relay described here has been built in two parts, a small

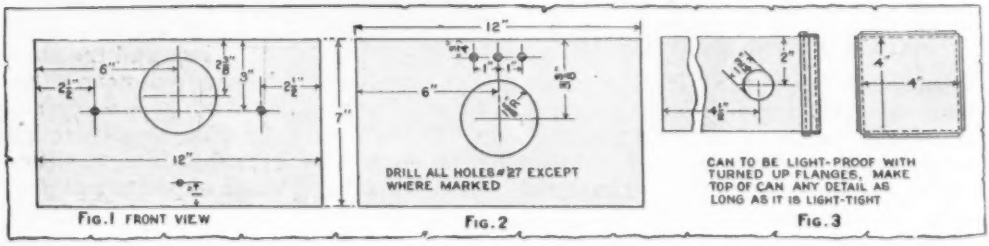
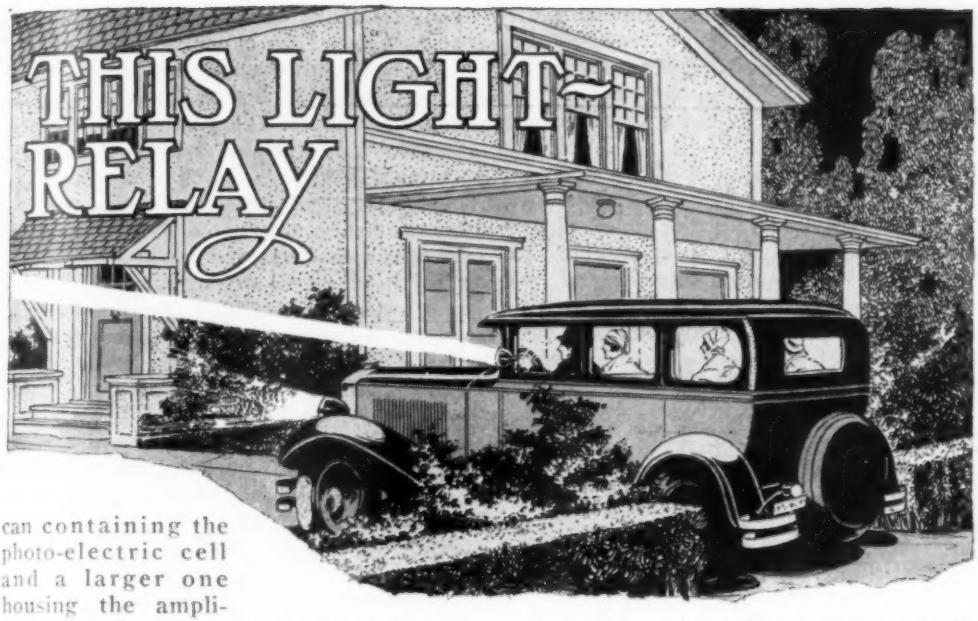


FIG. 1 FRONT VIEW FIG. 2 FIG. 3



can containing the photo-electric cell and a larger one housing the amplifier, controls and necessary batteries for operation. The reason for this is apparent, as it enables the user to place the cell in almost any position, or direction, without moving the large amplifier.

The large metal box may be made of either copper or aluminum and measures 12 in. long, 7 in. wide and 7 in. high. The front detail is shown in Fig. 1, the size of the hole depending on the make of milliammeter used. Fig. 2 shows the detail of the top cover, on which the sensitive relay is mounted with its three control points brought out to insulated binding posts mounted toward the rear, as shown in the photos. This No. 1 relay is a d.c. flush type adjusted to make contact at zero and 2 milliamp., respectively, and its position in the circuit is shown in Fig. 4.

The light-proof can for the photo-electric cell is detailed in Fig. 3 and it will be noted, in the photo above, that a short metal hood is soldered around the hole in the side of the can to assist in concentrating the light beam on the cell. This cell box is made of light metal and is just large enough to house the cell and its standard X-type four-prong socket. The housing boxes are both finished in black crystalline enamel.

The simplified wiring diagram is given

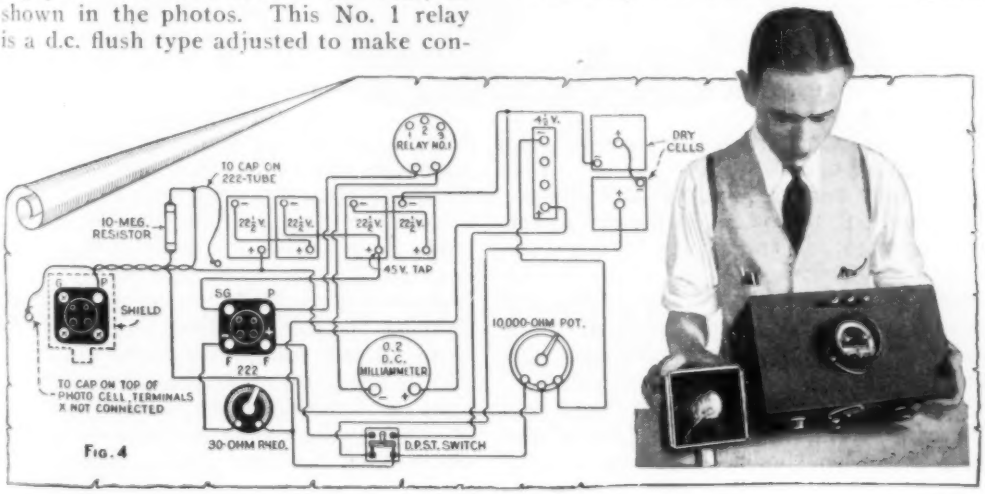


Fig. 4

in Fig. 4, and the parts are shown as nearly as possible in the same positions as they occupy in the boxes. All controls are mounted on the front, where they are easily accessible. For the sake of simplicity the switch that breaks the 3-volt and 4½-volt battery circuits is shown as a knife-blade type in Fig. 4. This switch, however, may be any of the standard two-circuit panel-mounting types, double-pole, single-throw. A complete list of materials is available upon application.

Mount all of the instruments and complete as much of the wiring as possible before placing the batteries in position.

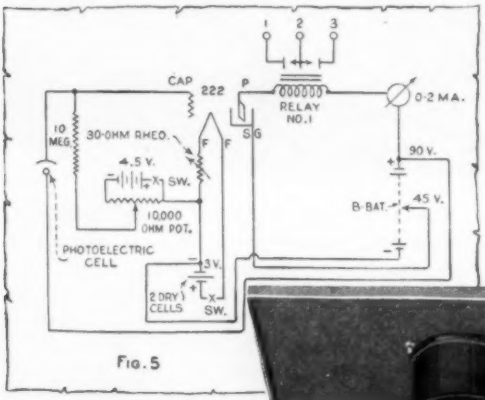


Fig. 5

Use well-insulated flexible hookup wire for all leads and make these leads as short as possible except the two leading to the posts on the relay mounted on the cover. These leads should terminate in lugs so that they can be quickly detached when it is necessary to remove the cover.

The four small 22½-volt B-batteries are arranged on the bottom of the can at the rear and are held in position by means of a strip of fiber or bakelite which is fastened to the side of the can at the left with a small bracket and at the right by a long threaded rod through the strip and the bottom of the can. The 4½-volt battery and the two dry cells for the 3-volt battery then fit snugly at the right of the B-batteries as shown. Be very careful not to let any of the relay terminals become shorted on can when removing lid.

As shown in the diagram, a screen-grid tube is used, with 45 volts on the screen and 90 volts on the plate. The 4½-volt C-battery is shunted with a 10,000-ohm variable resistor of the potentiometer type, making it possible to vary the bias on the tube from 0 to 4½ volts negative. The filament current for the tube is supplied by the two dry cells. The two-circuit switch breaks both the filament current and C-bias, thus preventing the current drain on the C-battery which would occur because the potentiometer is shunted across it. Relay No. 1 used in this instrument will break up to and including 100 milliamp., for such purposes as controlling receivers or for the operation of any apparatus within this current-drain limit. For heavier currents it is necessary to make this relay break the larger relay, No. 2, as shown in Fig. 7, and in this case a 6-volt battery is connected in series with the second relay as shown.

The sensitivity of relay No. 1 may be varied, making it possible to break the circuit with the slightest trace of light, or with a fairly intense beam. For example, adjust the meter to about 1.9 milliamp. and note that the relay is almost closed. This will have to be done with the photo-electric cell receiving a small and constant amount of light. Now, exposing the cell to a very small increase of light, such as that reflected from one's shirt, or reflected to the cell from a piece of white paper, as shown in the photo on page 1003, will click the relay shut.

To make the relay less sensitive, simply apply more C-bias and cut the plate current down; it will then be noted that it is necessary to direct considerably more light on the cell in order to increase the plate current enough to operate the relay. This is necessary when the constant room light is of normal strength and also applies when the device is operated out of doors. After a few simple experiments

the builder will find that the adjustment of the relay is very simple, and he can make or break circuits at will.

A layout diagram for a color-matching box is shown in Fig. 6. The photo-electric cell is placed in one section of this light-tight box and an ordinary mazda lamp in another compartment to serve as a constant light source. The windows are of clear glass and the box should be made of metal and well grounded. The light is focused through the lens on a piece of material inserted in the testing slot, and light from the material is reflected to the cell. The various pieces of material to be compared are then inserted in the testing slot, one at a time, and the reading is checked on the milliammeter of the amplifier which is in the control box.

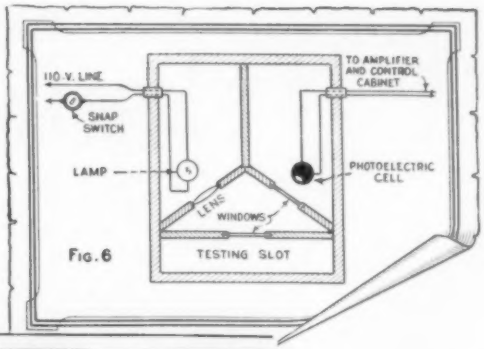
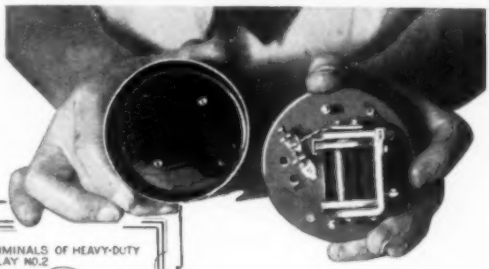


Fig. 6



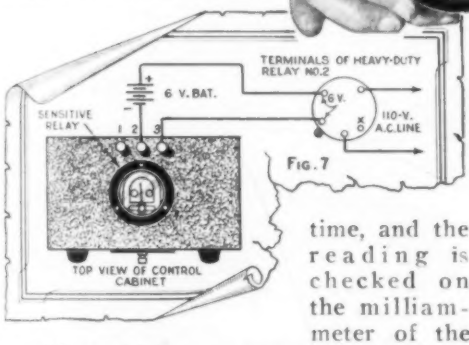


Fig. 7

Color screens, obtainable from the photographers' supply houses, may be used for greater accuracy if desired. Several different color screens may be used to check both samples, and if the meter readings are the same with each sample as checked through the screens, the colors are identical. The screens slide over the testing-slot window. It is not possible to cover the many useful applications in this article but the suggestions given will enable the builder to work out interesting adaptations and experiments for himself.

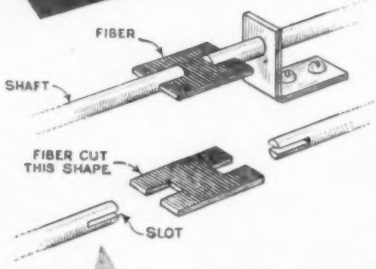
One precaution that the user should take, is not to subject the cell to very strong light, as this will ionize the cell, shortening its life and reducing its sensitivity. Also bear in mind that the milliammeter serves as a check and warning of overloads on the relay. At the first indication of overloading add relay No. 2, shown in Fig. 7. This is a rugged relay and very inexpensive. With this added relay it is possible to break heavier loads and control the operation of small motors and many electrically operated devices about the home. The terminal marked X on this relay corresponds in effect to post 1 on relay No. 1 and permits the operator to either make or break the circuit as he wishes or to make one circuit and break another. In all cases, however, the No. 2 post on relay No. 1 is a fixed connection, or, in other words, the unbroken line, and the other side of the line is the pivot point for the make-and-break contacts.

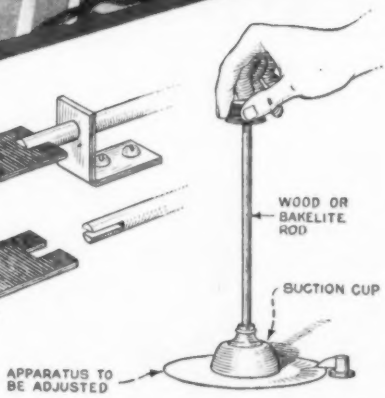
Sponge Remedies "Squawk" in Loud Speaker

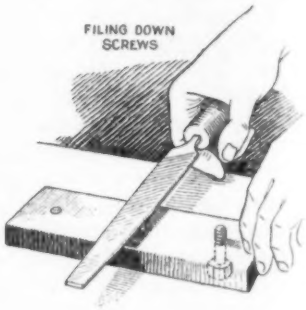
The writer, having a loud speaker that had a tendency to squawk or blast on certain notes, found a simple means of stopping the trouble, and the idea may be of benefit to others. The cause is usually some movable part that vibrates violently at a particular frequency. Speakers having thin metal diaphragms between the pole pieces, driving a small cone, are sometimes subject to this trouble. The remedy is a small piece of rubber sponge, about ½ in. square, wedged next to the diaphragm. If this does not stop the trouble, try it on the other side of the diaphragm, or on both. A little experimenting will locate the vibrating part.—J. D. Disbrow, Cleveland, Ohio.

Hints and Kinks

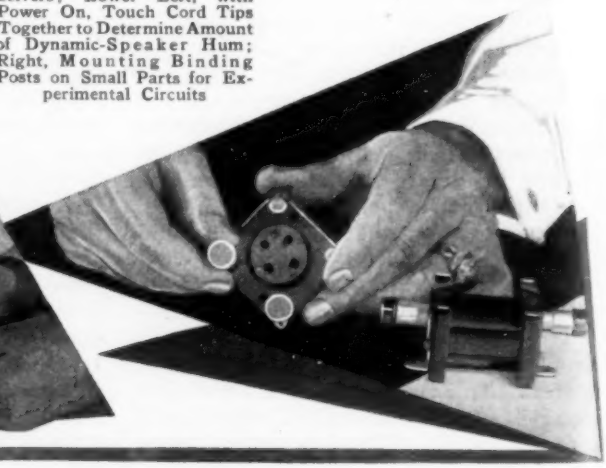
Above, Locating Trouble in Power Unit with Neon Tester for High-Voltage Circuits; Below, an Easily Made Jig to File Off Machine Screws Evenly without Damaging Threads; Left, a Small Vacuum Cup, Mounted as Shown, Makes an Excellent Device for Adjusting Delicate Apparatus without Adding Hand Capacity

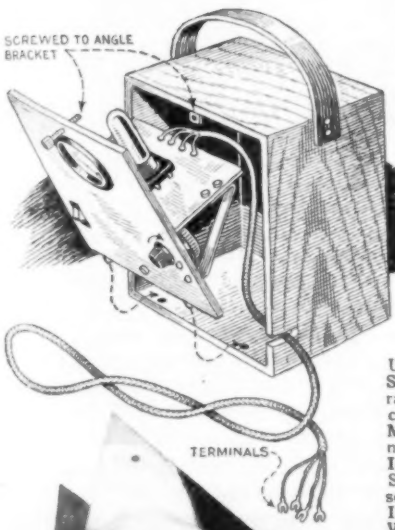


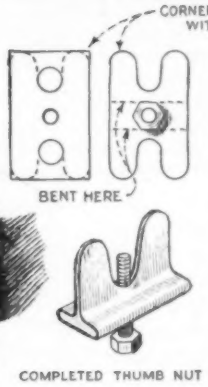




Upper Left, Insulated Shaft Coupling for Short-Wave Receivers; Lower Left, with Power On, Touch Cord Tips Together to Determine Amount of Dynamic-Speaker Hum; Right, Mounting Binding Posts on Small Parts for Experimental Circuits





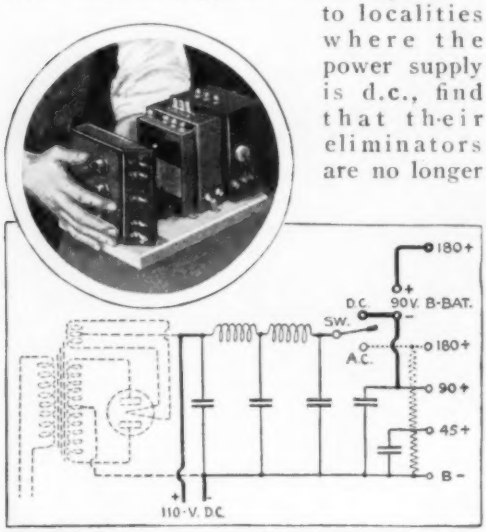


Above, for Accurate Receiver Tests Tubes Should Be Checked under Actual Operating Conditions; Left, a Handy Thumbnut for Quick Connections May Easily Be Made from Light Sheet Metal, Drilled and Cut as Shown; Bending the Sheet Metal over the Brass Nut Prevents It from Turning; If Stronger Construction Is Desired, Solder Nut to the Stock

Upper Left, Portable Sets or Testing Apparatus Made Easily Accessible by Simple Mounting Arrangement; Left, If Hum Is Reduced When Supply Plug Is Inserted in One Position, Identify with Dot of White on Plug and Socket; Right, Cone Speakers Need Occasional Adjustment for Atmospheric Changes

How to Alter A.C. Eliminators for D. C. Operation

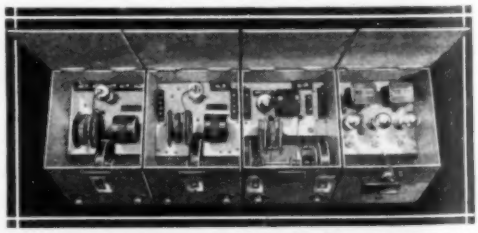
Many radio listeners, who have moved from districts supplied with 60-cycle a.c. to localities where the power supply is d.c., find that their eliminators are no longer suitable for operating the receiver. The circuit diagram explains the nature of the changes that must be made in an a.c. eliminator to convert it to d.c. The dotted lines indicate the parts which are removed, and the heavy lines the connections added. The transformer and rectifier tube are no longer used, but the choke and the entire filter section of the eliminator are retained. The filter section consists of the various filter condensers, choke coils and voltage divider. This voltage divider appears at the front in the insert photo and happens to be a housed adjustable type. The next two units are the filter-condenser blocks, and the power transformer is at the rear. The choke coils in this case are in the transformer housing, the terminals being marked No. 1 for the input, C for center tap and No. 2 for the output. Find the C-lead between the tube-filament supply terminals of the power transformer; it will be found that this lead goes to the input terminal of the choke coil where the positive 110-volt d.c. lead is to be connected. Trace the C-lead from the high-voltage secondary of the power transformer, which will be found between terminals marked H and H on the case, and connect the negative d.c. lead as shown. To find the polarity of the d.c. line, hold the bared ends of the supply line about 1 in. apart in a glass of salt water. Tiny bubbles will immediately appear at both ends, but more about the negative terminal. By means of the single-pole, double-throw switch the operator may quickly change from d.c. to a.c. operation at will; this switch may be omitted and the new connections made direct if desired. In either case it is necessary to make the change shown in the voltage divider as the approximate 100-volt output, when operated on the d.c. supply, will not give the correct voltages at the various taps as when formerly connected. If the original output was 180 volts, it will be necessary to connect two 45-volt B-batteries in series and insert them as shown, cutting out the original 180-volt tap. In case the total output was originally only 135 volts, only one 45-volt unit is necessary. The taps below 90 will supply the same voltages as before. The added batteries will have a long life and will be found to be very quiet in operation.—Elmore B. Lyford, New York City.



Power-Pack Eliminator Assembly for A.C. and, Below, Diagram Showing Connections for D.C. Operation

Short-Wave Receiver in Unit Form

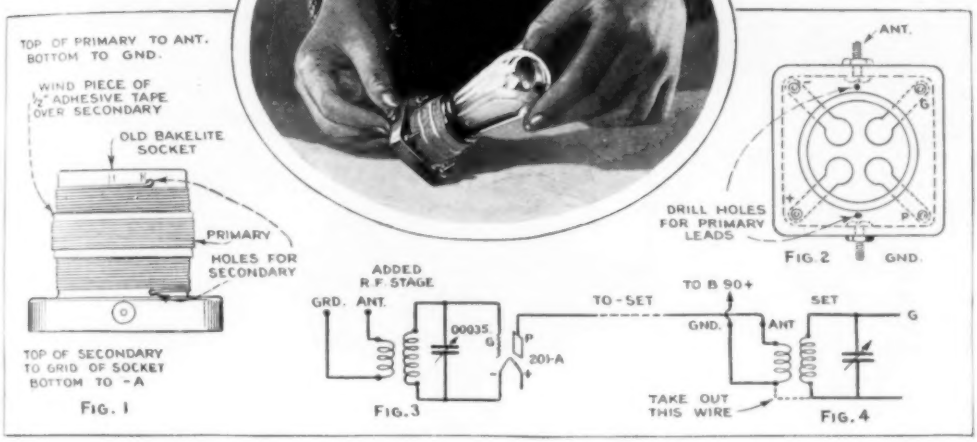
The short-wave receiver illustrated is a new unit assembly which allows maximum flexibility and the use of two, three or four units together as complete receivers. The simplest arrangement is the detector stage and audio unit combined. To this may be added the first r.f. stage, and later the second r.f. stage. For maximum range and audibility, the complete four units are suggested. Each unit is in an individual aluminum case, with hinged top and sloping front panel. The cases afford double shielding between the units, so essential in high-frequency receiver design.



Unit Type Short-Wave Receiver, Showing Hinged Lids Raised to Show Internal Construction

SIMPLE DEVICE FOR IMPROVING SELECTIVITY

An old bakelite socket of the UV-type, a .00035-mfd. variable condenser, a piece of scrap panel material fastened to a small baseboard, and a little wire, is all that is necessary to construct a very useful r.f. stage. This may be connected to any battery-operated receiver and will work very nicely if instructions are carefully followed. The coils are wound on the bakelite shell of the socket as shown in Fig 1, No. 28 d.s.c. or d.c.c. wire being used. The base of the socket is drilled to take two small brass machine screws and nuts to act as antenna and ground binding posts, as shown in Fig. 2. Wind as many turns as possible in a single layer on the form for the secondary, leaving 1/16 in. space at the top. The top end of the secondary goes to the grid post of the socket and the bottom to negative-A. A strip of adhesive tape, ½ in. wide, is wound around the secondary, and the primary, consisting of 30 turns, is wound over this tape. The top of the primary winding is connected to the antenna post and the bottom to the ground post.



Before you attempt to make the connections shown in Fig. 3, examine the antenna-coupling coil in the receiver, Fig. 4, to see just how it is constructed. If it consists of a primary and secondary coil joined together, as indicated by the dotted line, this wire should be cut away to separate the two coils. If the antenna coil consists of a single winding, a primary of 10 turns must be added near the filament end of the coil, so that the original coil becomes the secondary. One end of the primary winding, formerly the ground end, is taken to the 90-volt B-tap, and the antenna end is connected to P of the added socket. A 201-A tube is used in this socket, and its filament supply is obtained direct from the A-battery with a suitable filament-control ballast or rheostat in one side of the supply line.

Protecting Tubes That Are Lighted by Thirty-Two-Volt Supply

When the 32-volt farm-lighting current is used to light the filaments of the radio tubes through a resistor, cutting the supply down to 6 volts, there is some danger of burning out the vacuum tubes owing to the possibility of the lighting circuit becoming grounded. This rather expensive loss may be avoided by connecting a large fixed condenser, of about 2 mfd., in series with the ground lead from the set. This does not interfere in any way with good reception and isolates the radio set from a direct ground, thus preventing possible short circuits.

¶For further information on any radio construction article write to the radio department; this service is free.

It's Easy Man-Made

INTERFERENCE, especially the "man-made" variety, is in some instances so bad that it is impossible to use a radio receiver at certain times. The trouble in most every case is caused by some electrical device located in the near vicinity of the receiver. Refrigerators, vacuum cleaners, fans, oil burners, washing machines and, in fact, any electrically operated device may be the offender. An additional and very common cause of interference, especially in rural districts, are power-line leaks. These leaks may be caused by leaking insulators, or broken insulators that have allowed the line to drop down onto crossarms. Power lines running through or near trees are frequent offenders, as during wind and sleet storms leaks commonly occur. In towns and cities, power-line leaks will be found in defective transformers located in some near-by alley; poor grounds are also sources of annoying interference, and all such man-made static makers are quite difficult to locate unless the investigator equips himself with some such portable device as the one illustrated and described in this article.

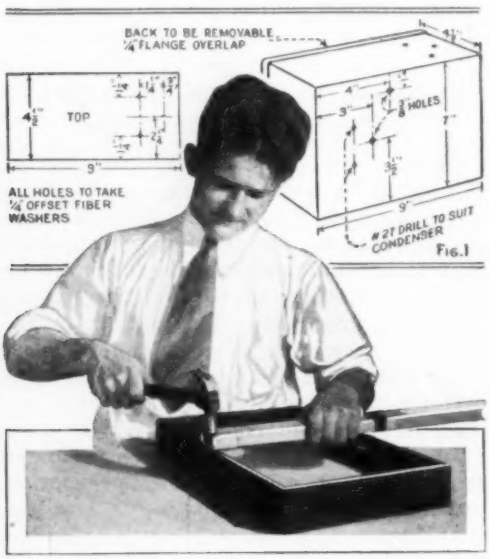


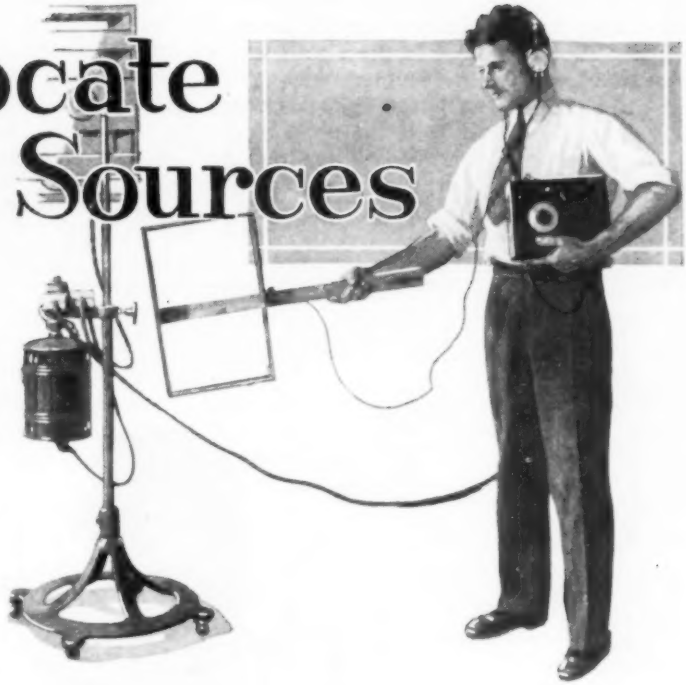
Fig. 1

The simple "interference hound" described here is a detector of the non-regenerative type, followed by one stage of audio in order to build up the signal strength in the phones to something like that picked up by the receiver in the home. It is designed to tune over the entire broadcast band, where the interference causes the trouble.

The instrument may be built into any of the large commercial stage-shields, but the one shown in the photos was housed in a homemade copper box, 7 by 9 by 4½ in., as detailed in the diagrams shown in Fig. 1. The back is made removable to permit the operator to get at the tubes and batteries when necessary. The completed instrument weighs only 8¾ lb. and can be carried about with ease. The rear-view photo and simplified wiring diagram, Fig. 2, show the arrangement of the various parts. The sockets for the two type-199 tubes are of the subpanel-mounting type, but in this case they are elevated above the base of the can by means of 1-in. lengths of fiber tubing. Two of these supports are used for each socket and 1¼-in.

to Locate Static Sources

by J. O. Barnes



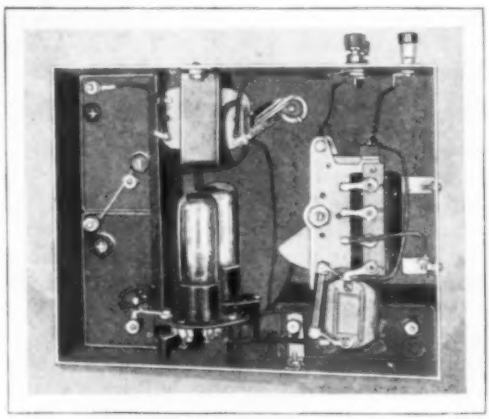
brass machine screws hold the assembly to the base of the can in the position shown in the photo.

The two small 22½-volt B-batteries are placed on end and fit snugly in the left end of the can. A thin strip of metal, 1 in. wide and 9 in. long, is bent over for ¼ in. to form a retaining bracket to hold the B-batteries in position, as shown in the photo. This strip is cut back along the ¼-in. bend for 1 in. at each end and the narrow section is cut away from these ends to permit a ¾-in. right-angle bend at the ends for fastening the strip to the can.

The filament-lighting battery consists of one 4½-volt C-battery mounted first on the base of the can at the right, and it is held in position by a 1 by 1-in. bracket. One end of this bracket is drilled to take the positive terminal of this filament battery and the other end is drilled to take a short machine screw which fastens the bracket to the can. This makes the can the positive side of the filament battery, therefore the positive filament posts of the two tube sockets are connected directly to the can. The negative end of the B-battery is connected to the socket-mounting bracket screw which makes the B-negative A-positive connection to the can.

The front of the can is now drilled for mounting the variable condenser and the filament battery switch. The variable condenser just clears the 4½-volt battery and is mounted in the position shown so that the rotor plates turn out toward the center of the can.

The coil for the tuned input is wound on a cardboard or bakelite tube, 1½ in. in diameter and 2½ in. long. Sixty turns of No. 32 enameled wire is wound on the tube, and the start and finishing ends of



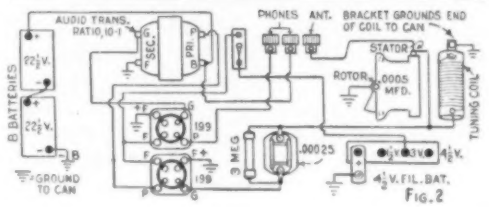


FIG. 2

the coil are soldered to lugs mounted under short brass machine screws at each end. The coil shown in the photo was a manufactured type provided with extra taps which were not used in this circuit. Fig. 2 shows the coil at the right; note that the coil is grounded to the can on the mounting bracket at one end and the free end of the coil goes to the stator of the variable condenser and to the gridleak and condenser of the detector tube. This gridleak and grid-condenser assembly is supported directly by the free-end terminal lug mounted on the coil form.

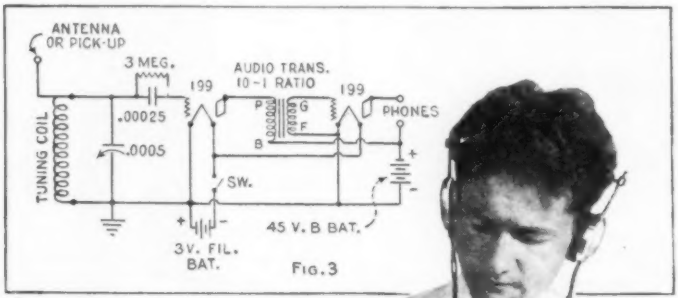
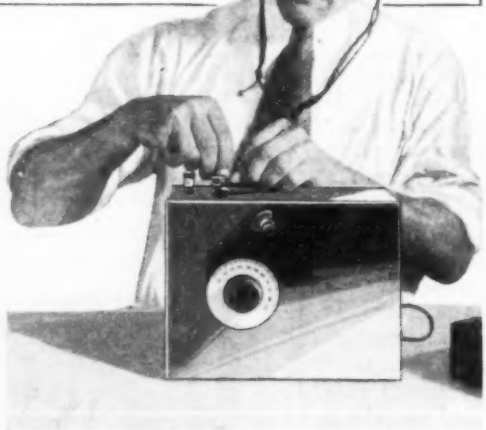


Fig. 3



The audio-frequency amplifying transformer is an inexpensive, unshielded, replacement type having a ratio of 10 to 1. It is mounted upside down to the top of the can, directly above the tube sockets. All wiring should be done with flexible insulated hookup wire. The filament switch shown in the simplified wiring diagram is a single-pole, single-throw type and is shown in this manner for simplicity; this type can be used by the builder, or any standard battery switch as desired.

The high ratio of the audio transformer is necessary for high gain, the response of which is not important, inasmuch as quality is of no concern. The binding posts for the phones and for the antenna or pick-up device are mounted on the top of the can, as shown in the photo on this page, and must all be carefully insulated from the can. This can be done by drilling holes slightly larger than necessary for the binding posts and using fiber washers above and below the top of the can to hold the posts away from the metal. When mounting and insulating posts in this manner, test each post with a voltmeter or phones in series with a small battery, to be sure that they are not grounded to the can, before wiring them into the circuit.

The antenna or feeler may be a simple loop wound on a frame, as shown in the photo on page 1008. A sectional bamboo fishing rod will make an excellent extension handle for a small loop when using it near power lines, but for the usual application a short wood handle will answer the purpose. In some cases, a feeler in the form of a single wire from this post and a small glass insulator on the opposite end with a hook fastened to it may be hooked directly onto the apparatus to be tested, giving a greater strength to the received signal, where the noise seems to be too feeble with the pick-up coil. This method, however, is not to be used around power lines, as the loop, even though quite a distance away from sources of power-line interference, will pick up a good loud signal.

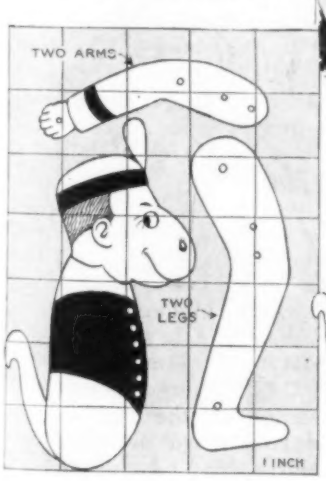
Light-Socket Antenna Kink

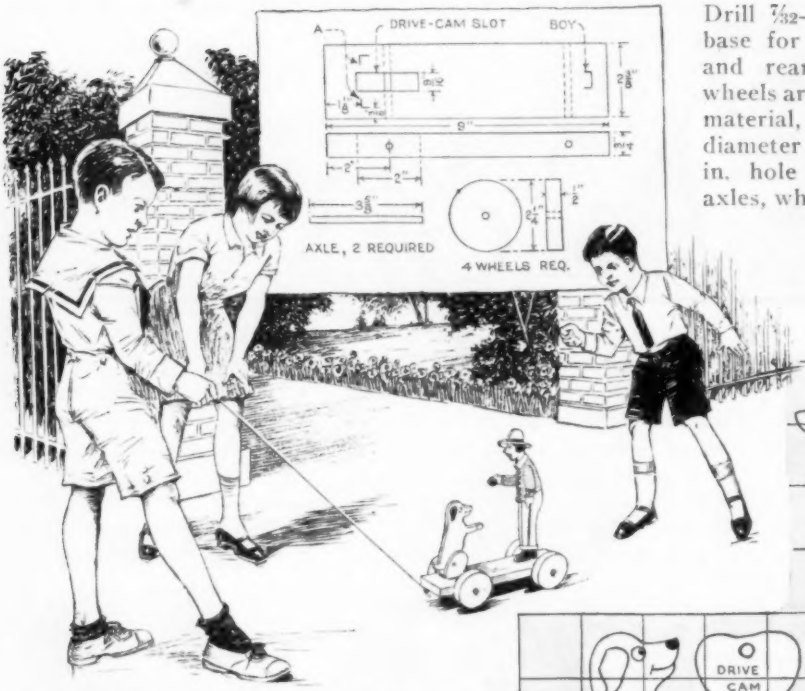
When using a light-socket antenna device consisting of a small fixed condenser, it is a good plan to connect a common 110-volt low-amperage fuse in series with the device to prevent burning out the coils in the set. Unless this precaution is taken, the condenser may break down and short-circuit the house-lighting current to the ground, causing serious injury to the set.—Harry L. Wynn, Derry, Pa.

Amusing Toys Easy to Make

TONY, the climbing monkey, climbs a rope in much the same manner as his live prototype, the organ-grinder's monkey, who is frequently seen on the city streets. Just pull the string and the monkey will climb to the top, the friction on the nails between his legs being greater than that of the felt between his hands. The moment you slacken the cord, the elastic bands pull the legs up, allowing the little fellow to get a fresh grip. Pulling the cord and then letting it slacken a little, pulling and slackening, etc., is the method used in making him climb. The legs, arms and body are cut from ½-in. basswood. Each part is filed and sandpapered smooth until all saw marks have been removed. Place the arms in the proper position and fasten them to the body rigidly by means of two 1-in. finishing nails or brads. The legs must be pivoted at the hips as shown, ¾-in. nails being used. Cut two ½-in. square pieces of felt to fit between the hands and glue and brad these pieces in place. Fasten a rubber band from each arm to the leg on the same side so that the band will hold the leg practically parallel to the arm. Drive two more nails through the legs at the points indicated, and then pass a length of strong cord between the legs, over the nails and between the felt grips of the hands, just as shown.

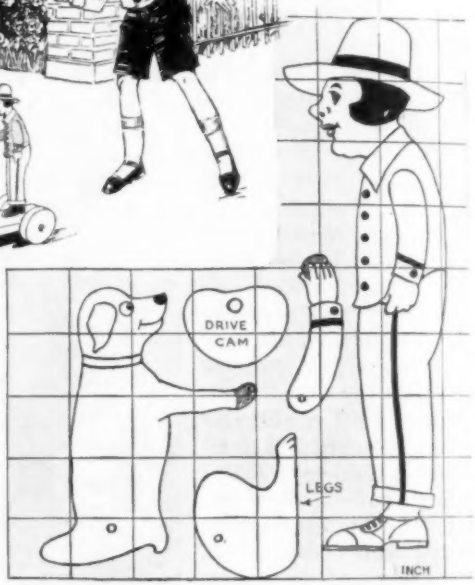
This Wooden Monkey Climbs a Cord in Real Monkey Fashion; Any Boy Handy with Tools Can Make It





Here Is a Wooden Pup That Jumps Up for a Bite to Eat, Just Like a Real Dog

Another animated wooden toy, which has been found highly amusing to the youngsters, is the begging pup shown in the second illustration. It is so constructed that it moves up and down when the cart on which it is mounted is pulled along, producing the same motion as a live puppy jumping for a bite to eat. To produce this effect, the dog is operated by means of a cam driven by a dowel rod which forms the axle of the rear wheels. The puppy stands erect during one half turn of the wheels, sits down during a quarter turn and rises during the last quarter turn, coming down immediately and starting all over again. The pattern is drawn full size and can be traced directly onto the wood. Use ½-in. basswood for all parts except the base. Cut out the parts with a coping saw and smooth all the irregularities produced by the saw with a file, followed by a medium grade of sandpaper. Drill 3/16-in. holes in the legs and body, and also in the cam. Cut the base out of material about ¾ in. thick, 9 in. long and 2¾ in. wide. The location and size of the slot to be cut in the base for the cam are shown in the drawing. Drill 7/32-in. holes in the base for both the front and rear axles. The wheels are cut from ½-in. material, are 2¼ in. in diameter and have a 3/16-in. hole drilled for the axles, which are cut from 3/16-in. dowel-rod material, 3⅝ in. long. To assemble the



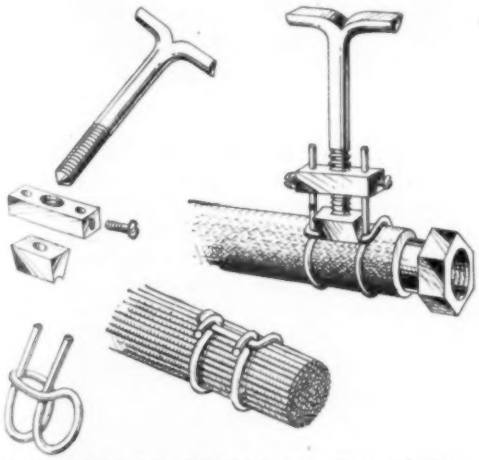
toy, first place the cam in the slot in the base, slide the axle through the hole in the base and the cam, and out through the opposite side of the base far enough so that the wheels can be glued on the ends. A drop of glue will hold the wheels and cam in place. In order to get the correct motion of the puppy, it is necessary to glue the hind legs at the exact location shown by "A" in the upper detail of the drawing. The holes in the legs should be directly over the axle. Use a 3/16-in. dowel rod to pivot the body in place, gluing the ends in the holes drilled in the legs. Allow the body of the dog to move freely. The figure of a standing boy is similarly cut out of ½-in. basswood. One arm is extended as if feeding the dog but the arm is securely fastened to the body. Use either paint or lacquer to decorate the toys over a good priming coat of shellac.

Electric Fan Prevents Photos from Sticking to Ferrotype Plates

When applied to ferrotypes it is quite customary to dry the photographic prints in the sun or in a drier, which often bakes the prints onto the surface and results in a large percentage of loss when removing them. Prints seldom if ever stick to the ferrotype if an electric fan is used to direct a current of air against them. When dry, the prints usually drop off the plates or can readily be removed. The saving in paper and time is far greater than the cost of the fan and the current to run it. Of course, your ferrotypes must be perfectly clean or the prints will stick under any circumstances.

Tool Clamps Wire on Hose

The tool shown in the drawing is used for applying wire on hose when binding it to couplings, or to bind together bundles of drill rod or round stock. It consists of a screw handle, a tapped crossmember with two holes to receive the wire and setscrews to hold the wire tight, and a guide block to hold both the wire and the end of the screw, a seat being drilled on the top side for the latter. The wire is looped double, and the ends are fastened in the crossmember by the setscrews. The handle is then tightened, and the whole device swung over toward one side, which



Easily Made Tool for Binding Wire to Hose and Tying Bundles of Drill Rod

action ties the wire as indicated.—Chas. H. Willey, West Concord, N. H.

Oilcloth Table Cover Rolled Up on a Curtain Rod When Not in Use

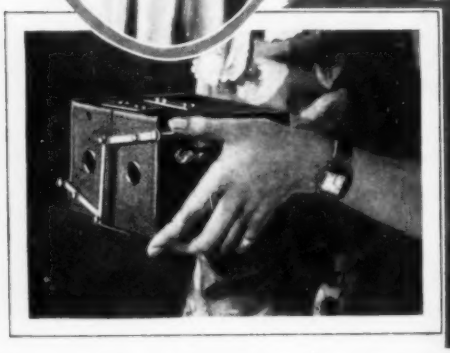
"Roll-Away" Cover for the Kitchen Table Mounted on Shade Roller

Oilcloth, mounted on a window-shade roller, so that it can be rolled up against the wall out of the way, as shown in the drawing, makes an ideal covering for the kitchen table. The oilcloth should be mounted with the shiny surface passing over the top of the roller. A hem should be sewed at the outer edge of the oilcloth for a window-shade stick. Art transfers or stencils will add materially to the appearance of the cover.—C. M. Perkins, Laguna Beach, Calif.

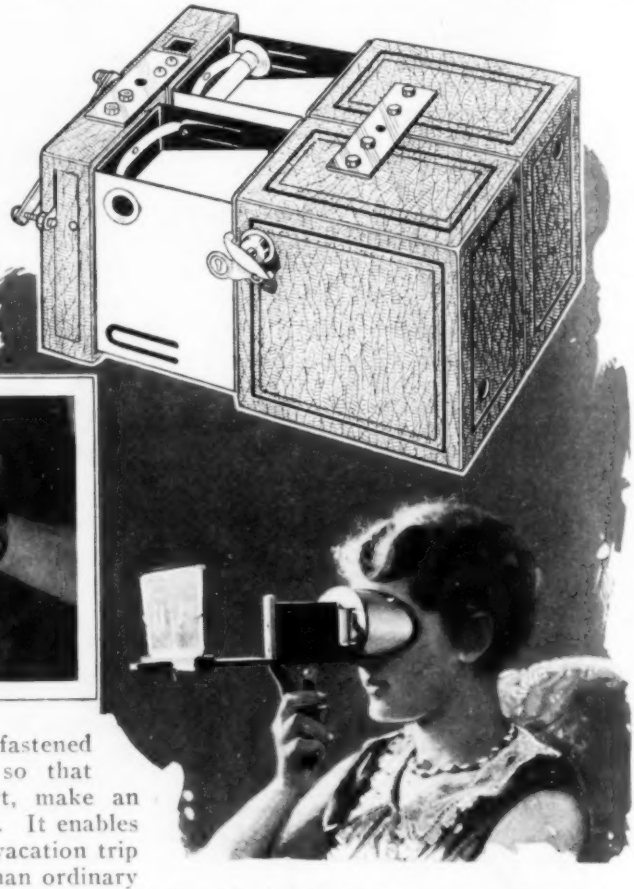
Fish Saved by Wet Hands

Millions of small fish may be saved each year to grow into large fish if anglers would follow one simple rule: Wet the hands thoroughly when taking little fish off the hook preparatory to releasing them. The fish should be handled gently and released under water, not thrown back. A dry hand destroys the protective film on the fish's body, which, once removed, permits fungus to attach itself to the body of the fish, and eventually kills it.—John B. Behrends, Chicago, Ill.

CHEAP BOX CAMERAS TAKE STEREOSCOPIC VIEWS



Homemade Stereoscopic Camera and Device for Operating Shutters at the Same Time



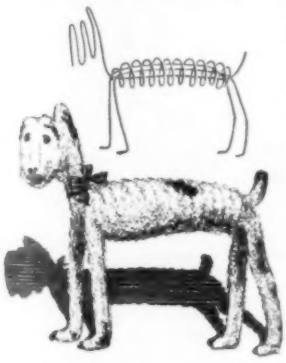
Two small box cameras, fastened together with brass strips so that the lenses are 2½ in. apart, make an excellent stereoscopic camera. It enables you to make photos of your vacation trip which will be more realistic than ordinary views. Usually the cost of stereoscopic photography has prohibited many from enjoying its advantages, but the cost of this outfit is so low that such objections are entirely eliminated as the cameras can be purchased for $1 each at almost any drug store. It is a comparatively easy matter to make a tripping-mechanism that will operate both shutters simultaneously, which is absolutely necessary, especially when taking a photo of a moving object. The left-hand detail clearly shows this mechanism, which consists of three flat brass links pivoted end to end, the two on the outside being pivoted to the front, as indicated, and connected to screws on the shutter trips. In this way, the movement of one trip is directly transmitted to the other. The drawing also shows how the two cameras are fastened together side by side, it being necessary to reverse them so that one will be upside down, on account of the film-winding nuts, which must be on the outside. Four brass plates are used to hold them together rigidly, two at the top and two at the bottom, and if desired, a nut may be soldered to one of the bottom plates to fit a tripod screw. It is essential to arrange the plates as shown so that the backs of the cameras can be conveniently removed in order to permit the insertion and removal of the films. If a little judgment is used in selecting scenes to photograph, surprising results can be obtained. The object of interest should be located in the immediate foreground with a satisfactory background to set it off.

If the object is too far in the background, the stereoscopic effect will not be so pronounced.

Mounting the photos must also be done with extreme care, placing the right-hand photo on the right side of the card that fits the holder of the stereoscope, and the left-hand photo on the left side. It may be well to clip the pictures on the card with ordinary paper clips until the best arrangement is obtained. Trim off the edges of the prints and, when properly adjusted, paste them down with rubber cement, which will not cause the card to warp. The size of the card is 3 by 6½ in., and the corners are rounded. If you have some stereoscopic cards on hand, the photos can be attached to the back. To obtain the best results the photos, when mounted, should be separated by not more than ½ in. If they are too far apart, or if one is lower than the other, they will not merge together properly. The lenses of the stereoscope act as prisms and bend the light rays to a common focus, thereby merging both photos into one. The realistic effect of stereoscopic views is obtained by taking both photos from slightly different angles in the same manner as our eyes. This causes the objects photographed to appear free-standing as in nature, or, in other words, a three-dimension effect is obtained which gives stereoscopic views their peculiar "depth."—Arthur O. Hein, Chicago, Ill.

Miniature Animals Made from Pipe Cleaners

Miniature animals, such as dogs, horses, etc., that may be used as toys or for decoration, can be made by merely twisting ordinary pipe cleaners to the proper shape. Ink spots make the eyes, nose and mouth, and a colored ribbon is fastened about the neck. The drawing shows an example of the work.—I. R. Hammer, Burlington, Iowa.



Pies Displayed on Restaurant Counter Protected by Bent Wooden Guards

Guards for Pie Display on Counter

Wooden guards, bent to a semicircular form having a radius a few inches larger than that of an ordinary pie, are used for protecting the latter when set on a restaurant counter for display. Small brass angles are used to hold the guard to the counter securely, and a piece of plate glass can be placed over the guard, to keep out falling crumbs and make the display sanitary. In this way, the pies are set right before the customers, and the proprietor claims that the idea pays.

Starting Small Screws

There is often a good deal of time and patience lost when starting tiny screws. A screwdriver is not serviceable for the purpose and holding them with the fingers is very awkward. A good method is as follows: Pare down the end of a match stick just enough to fit snugly into the slot in the screw head. Then moisten the end of the stick, put it into the slot and start the screw. A good hold is possible because the wetted match stick swells in the slot. Very small screws can be started in this way.

¶A deep-red stain for wood can be made from alkanet root, ½ oz., and turpentine, 2 fluid ounces.

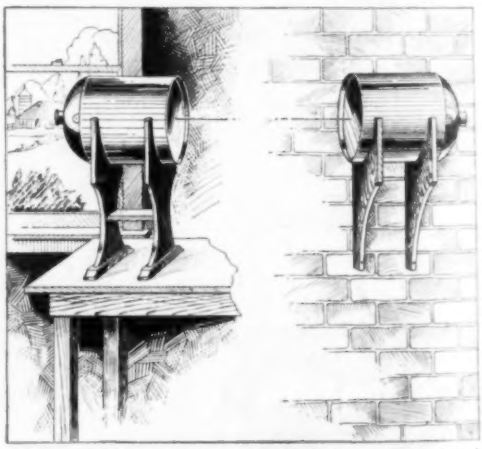
Small Boats for Model Ships That Resemble Real Ones Can Be Made from Visiting Cards

Making Small Boats for Ship Models

In making fittings for ship models, one of the most tedious jobs is the construction of small boats which will bear resemblance to the real thing. After considerable experimenting, I found that they could be made from visiting cards with very little trouble. The method of doing this is as follows: Cut a card to the approximate shape shown in the detail. After a few trials it will be found easy to produce the desired flare and curvature of the gunwale. Mark off pencil lines to represent the ribs inside and on these paste narrow strips of thin blotting paper, then similar strips for the rails over the ribs. Press the work in a vise to bed it down properly. Then cut a narrow strip of passe-partout paper, crease it lengthwise over a thick piece of cardboard and lap it along the gunwales. A few small nicks will prevent wrinkling. Fold the boat along the center line, roll it around a pencil to make it a bit more flexible and bind the bow and stern ends together with small pieces of gummed tissue paper. A little manipulating with the fingers will accomplish whatever final shaping is necessary. Paste another narrow strip of blotting paper from stem to stem for the keel. Shellac the boat inside and out to stiffen it and then paint it, putting on enough paint at the bow and stern to hide the tissue-paper binding strips. Cut the thwarts from strips of stiff cardboard and set them in place with a dab of glue on the underside at each end. These boats are better than wooden ones.—A. V. McDermott, New York City.

Odd Telephone Made from Oilcans

Two neighboring farmers who had no telephones, established communication between them by means of a long wire tied at either end to an ordinary oilcan as shown in the illustration. A hole is punched or drilled in the center of the bottom of each can, and the wire is passed through the holes, after which a knot is tied at the end to prevent the wire from slipping out again. The wire is stretched between the cans and does not touch anything between the terminals. Consequently, vibration of the can bottom, which is caused by sound, is instantly transmitted over the wire to the opposite can bottom, which, acting as a diaphragm, converts the vibration back into sound. A hand bell or cow bell is used to attract attention before starting a conversation. This odd telephone system has been found practical over a distance of 300 yards, crossing a small river which separates the farms. Two methods of mounting the oilcans are shown. Each is used both as a receiver and as a transmitter.—James Wilson, Montreal, Can.



Oilcans Which Provided Terminals for a Mechanical Telephone Line

Grotesque Figures Crack Nuts

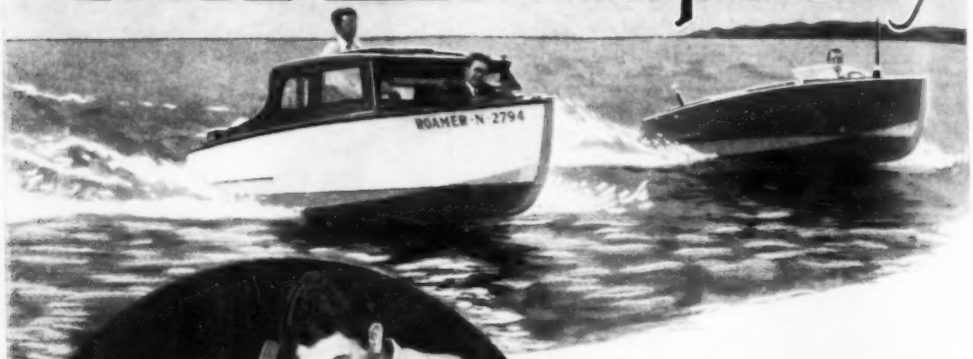
The grotesque nutcrackers shown in the photo, as can readily be seen, are really useful besides being ornamental. They are carved out of hardwood, and the jaws in five of the models shown are pivoted so that, when opened, the nut can be slipped between them and sufficient leverage is provided for breaking the shell. The sitting clown, however, is pivoted at his feet and cracks the nuts by "sitting" on them. Anyone who likes to tinker with tools can easily make these nutcrackers and they will be found highly suitable for Christmas gifts.

Useful and Ornamental Nutcrackers Made of Hardwood; the Nuts Are Cracked between the Jaws

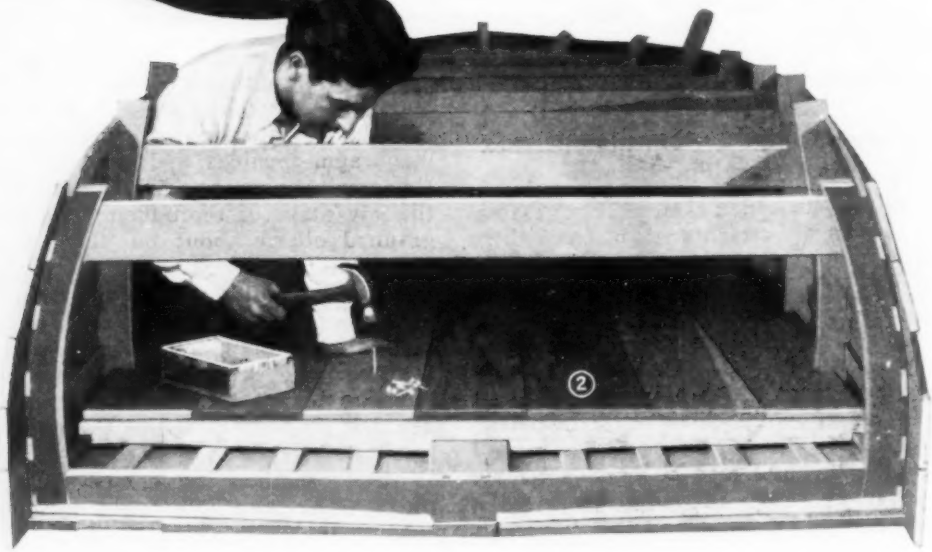
Photographing Close-Ups with Graflex at Twenty-Four Inches

Owners of Graflex cameras, not possessing a portrait attachment, often wish to take a close-up of a person or object. A simple method of doing this without the expense of purchasing a portrait attachment, and one that has been found to give good results, is as follows: The removable lens mounting, with which most of these cameras are equipped in order to permit cleaning the reflecting mirror, is taken off with the lens in it, and the whole assembly is reversed. Close the mounting cover in the reversed position and the camera is ready for close-ups. By experiment it has been found that it is possible to obtain good, clear photos as close as 30 in. from the photographed object with the large diaphragm openings, and up to 24 in. with the small openings. This method has the advantage of reproducing the photographed object about one-third normal size. After the picture has been taken, lift out the lens and mount, and return them to their normal position, so that the camera will again be ready for regular work. Ordinarily, 5 or 6 ft. is the minimum focusing distance of a single-bellows Graflex, but on such close-ups the details of small objects do not stand out clearly. With the method just described the minutest design can be brought out clearly. —Kenneth Keith, Chicago, Ill.

"ROAMER" A Speedy



WITH work to be done this month, "Roamer" begins to take on the appearance of a finished runabout. However, this hull does not make a good outboard runabout, and should not be built as such. "Roamer" makes an excellent runabout if powered with an inboard engine, and a good sedan cruiser with an outboard motor, but is decidedly unsatisfactory as an outboard runabout. There is considerable beam amidships which quite handily takes care of the weight of the cabin in the sedan-cruiser design



Outboard Cruiser

Part 3— by Sam Brown

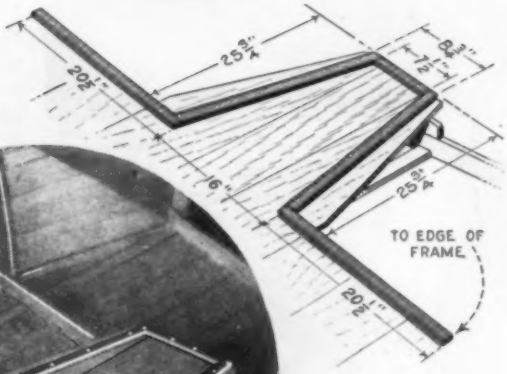
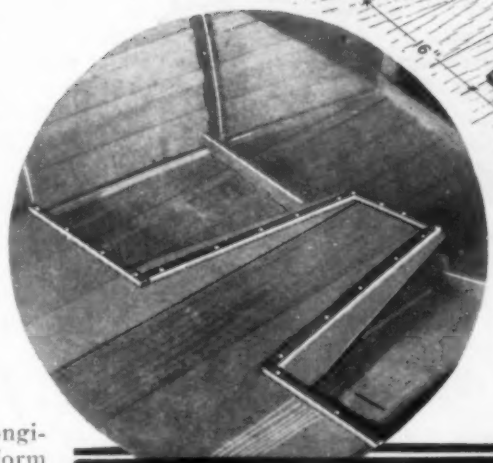


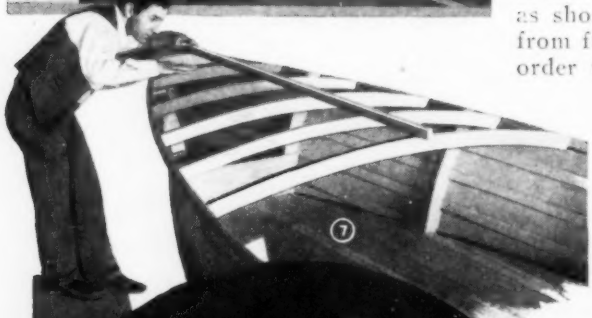
FIG. 3



Pieces of ⅝ by 1¼-in. Stock Shown Nailed to Floor Are Nailing Strips for Sides of Bunks

or the weight of an inboard motor in a runabout design. Putting an outboard motor at the stern without the compensating weight of the cabin is something which can be done only by sacrificing the balance of the hull. If you desire to convert this craft into an inboard runabout, now is the time to put in the longitudinal beams to form the engine bed.

Flooring for the cruiser is ⅝-in. redwood, used in 6 or 8-in. widths. Before this can be fastened, additional crosswise supports, one between each of the frames, must be placed, as shown in Fig. 1. These are notched to fit over the keel and chine, then fastened into position with galvanized nails. Since the frames are not level on top, they must be shimmed up with suitable pieces to bring all of the floor beams level, a level line being automatically secured by blocking up the rear end of the boat to a height of 28 in. above the floor level, and



the forward end, at the end of the keel, to a height of 21⅜ in. above the floor level, the same measurements as were used in setting up the framework. Or, measuring up 1⅜ in. from the keel between frames 7 and 8, and 3½ in. up from the keel between frames 4 and 5 will give you two points to determine the level line. The level line crosswise is obtained by equalizing the distance from the floor up to the chine on each side.

The flooring is simply nailed in place, as shown in Fig. 2. The central plank, from frame 7 forward, is left unnailed, in order to get at the bottom of the boat. The flooring does not extend to the stern, being stopped on an intermediate beam between frames 7 and 8. Neither does the floor extend to the stem, but is stopped at frames 4 and 3, to form the shape shown in Fig. 3. The pieces of ⅝ by 1¼-in. lumber, shown nailed on the floor, are supports to which the bunk sides are fastened. To these strips are nailed the 5-in. widths of ⅝-in. redwood which form the sides of the bunks. Frames 1, 2 and 3 are spanned across with pieces of 1 by 2-in. lumber to carry out the level line formed by the bunk side-pieces, and the whole thing is floored with ⅝-in. redwood, as in Fig. 4. Three planks, one in the center of each leg of the "A" and one in the main body of the bunk, are left unnailed to furnish lids for the locker spaces below. The extreme nose of the boat is floored with ⅜ by 1½-in. strips of redwood, extended from chine to chine.

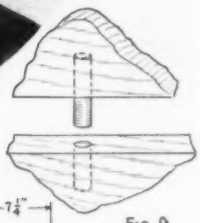


Fig. 9

Now for the deck beams. Commence by cutting off the tops of the frames flush with the planking, Fig. 5. Then, from 10 by 5 by 2¼-in. yellow pine, cut a three-sided piece which will fit exactly into the nose of the boat. This block should be securely screwed ½ in. above the line of the top planking, and then dressed down, as indicated in Fig. 6.

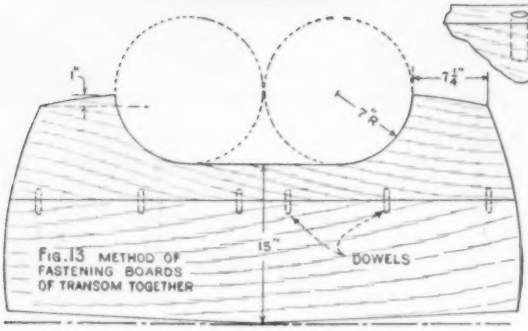
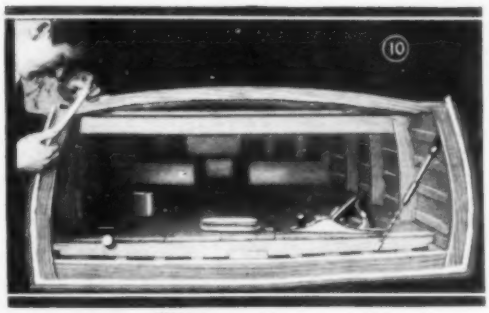


Fig. 13 METHOD OF FASTENING BOARDS OF TRANSOM TOGETHER

to show a rise of ½ in. in the center.

There are five main beams on the forward deck, spaced on 10½-in. centers, measuring from the rear of the block just fastened. The center of the final beam should measure 62½ in. from the extreme nose of the boat. These beams are cut from ¾-in. elm, and should be uniformly 2 in. wide throughout their arcs. The curve of the beams gradually becomes greater as the distance spanned becomes wider, the extreme arc on the final beam being 2½ in. The arc of the intermediate beams can be easily obtained by using two pieces of straight timber, one lengthwise, as in Fig. 7, and another from side to side at the beam station. Mapping out the curves can best be done with a light piece of straight-grained, uniform wood, spanned from end to end of the required curve and held up at the center to the required height of the arc. Each beam end is butted directly against the top batten, and fastened from the outside with two 1¾-in. No. 8 brass screws.



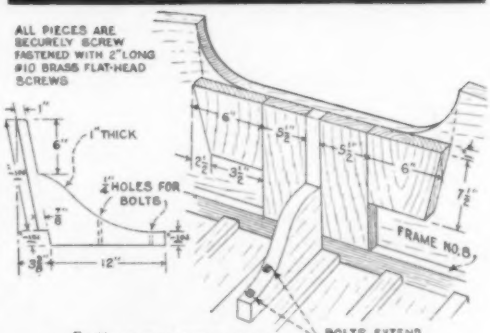
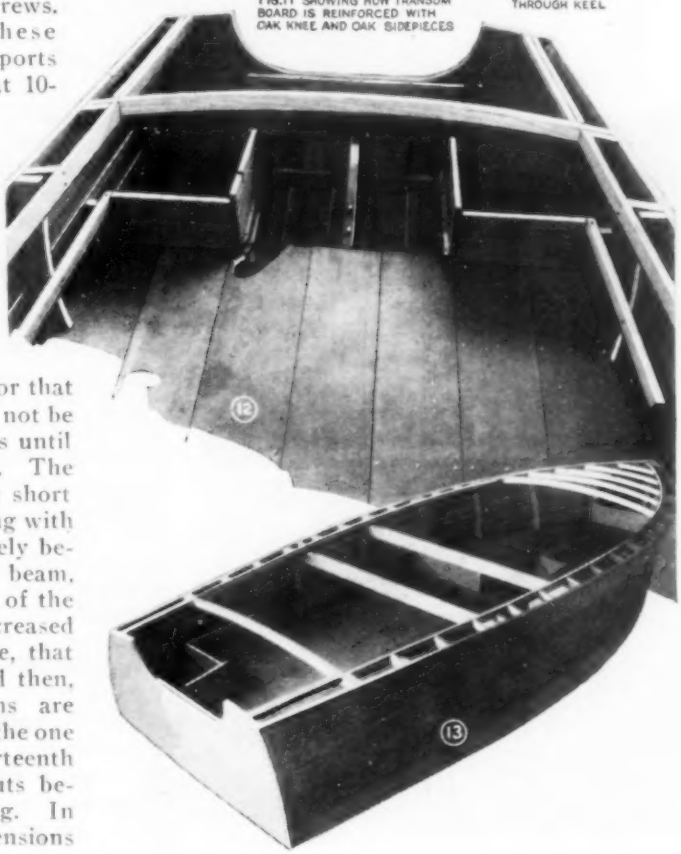


Fig. 11 SHOWING HOW TRANSOM BOARD IS REINFORCED WITH OAK KNEE AND OAK SIDEPIECES

Extending aft from these main beams, the deck supports consist of short sections at 10-in. intervals, which carry out the same arc as the final crosswise beam. You should constantly check this arc by using a board, as in Fig. 8, with the proper curve outlined upon it. Fitting these short beams usually requires considerable recutting and beveling, and for that reason the free ends should not be cut to the exact dimensions until the beams are all in place. The exact dimensions of these short pieces are variable. Starting with a doubling piece immediately behind the final crosswise beam, which is 5¼ in. long, each of the two succeeding beams is increased ⅛ in. over the one before, that is, 5⅜ in. and 5½ in.; and then, the ten succeeding beams are each decreased 3/16 in. over the one before to make the thirteenth beam (10 in. or thereabouts behind frame 7) 3⅝ in. long. In sawing them to these dimensions



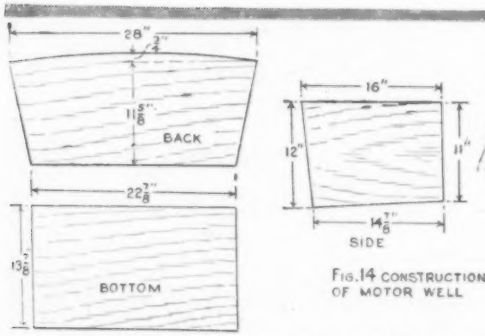
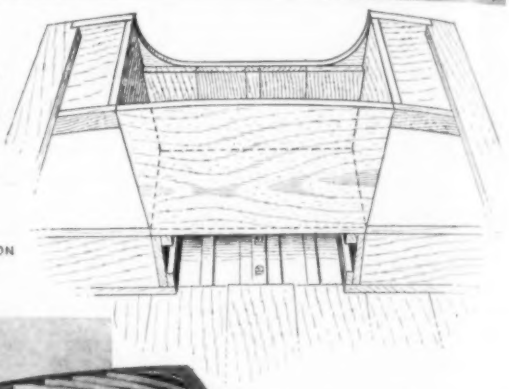


Fig. 14 CONSTRUCTION OF MOTOR WELL



after they have been fastened, make sure that each end is plumb, and you will be saved considerable annoyance in the later fitting of the cabin supports.

One other crosswise beam, immediately behind the final short beam, is necessary to complete the cross supports. This beam carries out a trifle less arc than the final beam on the main deck.

Of course, lengthwise beams are necessary to tie these crosswise supports together. A strip of 5/8 by 2-in. elm is used across the ends of the short beams, and the line formed by this piece, 5 1/4 in. in from the side of the boat at frame 3, is carried out by a centerline along short 3/4 by 1 1/2-in. pieces toenailed between the main deck beams, as can be plainly seen in Fig. 13.

The transom or stern board will require a piece of mahogany or oak, about 52 by 23 by 7/8 in. A piece of this size is usually unobtainable, so use two pieces, fastening them together with 1/2-in. dowels, as in Fig. 9. Keep this joint high so that it will be above the waterline. This board must be fitted inside the planking, and tight up against frame 8. The exact outside shape is best obtained by trimming the plank ends to within 1 in. of the frame, then fitting the transom against the cut ends and penciling around it along the inside of the planking. With perhaps a slight variation, depending on the motor used, the upper portion of the board will be

of the shape shown in Fig. 9.

Before putting the transom into place, it is necessary to calk the inside of the frame with cotton, as shown in Fig. 10, in order to insure a watertight job. The fastenings are flat-headed brass screws of suitable length. If you contemplate a paint finish, these should be driven flush; if you are thinking of a varnish job, they should be counterbored with a 3/8-in. bit and the holes plugged with suitable crossgrain wood plugs. These are held in place with shellac or waterproof glue. They should be selected for color, and should be so inserted as to carry out the original grain of the board.

The transom, in itself, is not strong enough to withstand the constant vibration of the average outboard motor, and must be reinforced with an oak knee and sidepieces, as shown in Fig. 11.

You can now continue the deck beaming to the rear of the boat, as shown in Fig. 12. Notice that each corner of the boat is floored over, and that two 7-in. and two 6-in. widths of redwood are used to form the risers for the motor well and battery-locker compartments. The 3/4 by 1½-in. strips of wood along the sides of the boat are supports for the rear seat, but this is not put in until later.

Fig. 13 is a general view of the boat at this stage. Completing the motor well is simply a matter of a floorboard, two sides and a back, as shown in Fig. 14. It is necessary to cut the crosswise beam, letting the back of the well carry the arc across from side to side and joining the beam at each end.

The first step in putting on the deck consists in applying the two long strips of 3/8-in. mahogany which run the full length of the boat, as shown in Fig. 15. Because of the wide arc of these pieces, they must be put on in two

sections, the joint occurring immediately behind the last forward beam, as shown in Fig. 16. This joint should be neatly butted on a bevel and securely fastened to a wood block underneath. Fig. 17 shows how each of the two sides is joined at the nose of the boat. Fastenings for the decking consist of 1-in. galvanized nails, countersunk in 3/8-in. holes, which are later plugged with wooden boat plugs. No great pains need be taken to get a perfect fit on these side deck pieces, since most of the trimming, except on inside forward and rear edges, can be done with a plane and drawknife after the wood is securely fastened.

The rest of the decking on the boat is cut from 8-in. widths of mahogany, each piece scored with three saw-cuts to imitate narrow strips of planking. These widths are laid lengthwise, as shown in Fig. 18. The edges of joining widths should be slightly beveled in order to carry out the cut-planking effect, and this beveling should also be done along the entire inside edge of the long outside piece where it joins the saw-cut planking. All joining edges and all saw cuts should be filled with regular seam composition, which is elastic and does not crack under contraction and expansion.

A hatch in the forward deck is quite convenient, both as a means of ventilation and for seating a passenger. This should be cut as the planking is being laid. Fig. 19 shows its simple construction—merely a matter of sawing the center beam, and edging in the lid and the opening with suitable pieces of timber.

A craft of this type looks best if the inside is covered, as shown in Fig. 20; 3/16-in. mahogany was used on this boat, but any stock fiber board will serve. Light strips of wood are fastened to the floor to furnish a support for this paneling.

"Roamer" should carry a gasoline tank of at least 10-gal. capacity. Fig. 21 shows how this tank, a wide, flat type,

is carried under the rear seat. The flooring and one well support must be cut to allow the feed line to enter one of the side-locker spaces. Other details on the gasoline feed will be described in a later article.

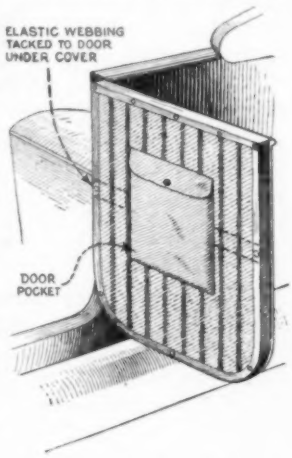
Fig. 22 shows the riser for the front of the seat. This should be rounded on the top side and carried 2 in. above the actual 6-in. seat level. The main idea of this picture, however, is the seat back, which consists of three equal pieces of 5/8-in. redwood, the center piece being fastened permanently and the two outside pieces hinged at the bottom edge to permit entrance into the lockers. The top side corner of each of the two outside pieces must be notched out, 1/2 in. down and in from the long deck beam, to permit fitting of the coaming strip, to go on later. Experience has shown that these seats might well be 4 or 5 in. higher without detracting from the appearance of the boat, while adding a lot to its comfort.

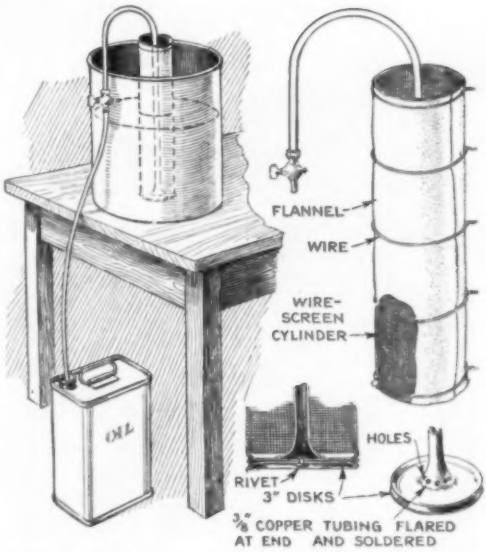
Fig. 23 is your outboard runabout—unfortunately an impossibility. Notice, however, the neat appearance of the same hull in the double cockpit, inboard-runabout design, shown in Fig. 24.

(To Be Continued)

Elastic Supports for Auto Door Pockets

Door pockets used with seat covers are usually rather difficult to apply so that they will lie flat and also allow the hand to be inserted. To overcome this trouble tack the side of the cover to the door only at the top and bottom and attach elastic webbing between the edge of the door and the outer edge of the pocket, as shown. When the hand or contents is removed from the pocket, the elastic will draw the cover flat against the door again.—E. T. Gunderson, Jr., Humboldt, Iowa.





Easily Made Filter for Straining Dirty Gasoline and Old Oil and Even Homemade Beverages

Efficient Filter Easy to Make

A simple filter, which will remove all sediment from dirty gasoline or engine oil and can also be used in making beverages, is shown in the illustration. It filters the liquid at the source and, because of its large area, is comparatively rapid in action. Two tin disks, about 3 in. in diameter, are riveted together. The tops of tin cans, cut with the roller type of can opener, are suitable for this purpose. A 3-in. length of 3/8-in. copper tubing is bent as shown, the straight end being flared out to about 3/4 in. and then soldered to the center of the disks. Small holes are drilled around the base, as indicated in the lower detail, and a shut-off cock is fitted to the other end of the tube. A length of copper or galvanized wire screen is rolled into a cylinder to fit snugly over the disks. It is wrapped tightly over the disks with copper wire and then soldered. The screen is next wrapped with about 1 1/2 yd. of outing flannel and tied with cord. The material of old cement sacks is even superior to flannel. The filter is placed into the fluid to be filtered and the siphon is started. The shut-off cock regulates the flow. The slower the flow is, the more thorough the filtering will be.

¶A pencil eraser will polish a gold piece and make it look fresh from the mint.

SQUIRRELS CANNOT GET AT THIS FEED BOX

ed of almost any kind of lumber, or an ordinary grocery box will do. A couple of small galvanized-iron pulleys and a length of galvanized-iron wire, about ⅛ in. in diameter, are used to suspend the box in the open. Two screwhooks are driven into the ridge of the roof for attachment to the pulleys. A wire is slipped through the pulleys, one end is attached to the house near a window or door, and the other end, at a slightly lower level, to a tree or any other convenient object. A string, tied to the box, serves to pull it within reach to replenish the food supply without going outdoors. A slight shove sends the box down the wire. Loose food is placed in the bottom of the box, but

Mr. Squirrel Can't Get At the Food on This Bird-Feeding Platform, Which Runs on a Length of Wire and Can Be Reached without Going Outdoors

Here's good news for the winter birds: a squirrel-proof feed box. The materials required to make it are simple and inexpensive. The box itself can be constructpieces of suet, which are much prized by most birds during the winter, should be tied to the uprights.—Robert H. Moulton, Glencoe, Ill.

Carrying a Danger Signal on Highways

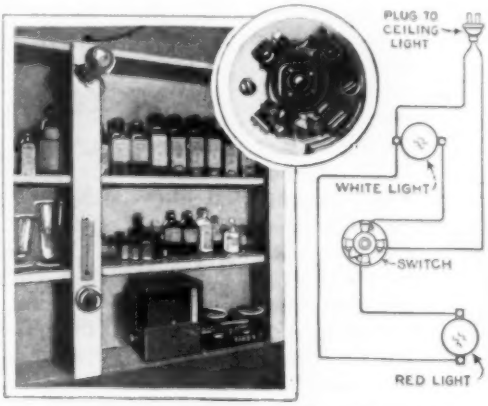
A farmer living along a well-traveled highway became concerned with the safety of his little girl, who walked occasionally along the highway after dark to the nearest village, about a mile distant. He hit upon a simple danger signal, which anyone can use. Two red celluloid disks, connected together with two lengths of cord were hung over the girl's shoulders so that one disk would hang in front and the other behind. The light of approaching cars was reflected by the disks, which thus provided a warning to the motorists. The idea was found entirely successful, and the little girl walks on the road in comparative safety.

Preventing Corrosion in Deep Engraved Monograms

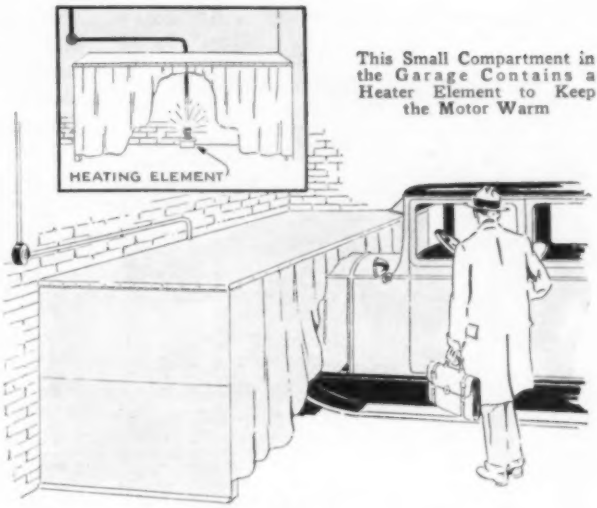
Engraved initials on watches, rings and other jewelry often penetrate to the base metal beneath, which is then subject to corrosion. In the case of wrist watches, the green corrosion gets on the wearer's wrist. This can be prevented, and the appearance of the jewelry greatly improved, by the following process: Dissolve some paraffin in benzine; place a small quantity on a dry cloth and with it lightly rub over the surface of the engraved article, being careful not to allow any of the solution to get into the lettering. For intricate designs, use a small camel's-hair brush. The article can then be plated by any of the processes described on page 516 of the September, 1930, issue of Popular Mechanics. The portions to be plated should be thoroughly cleaned before the paraffin solution is applied. Remove the works from a watch case before submerging it in the plating solution. The plating will only adhere to the exposed metal portions of the lettering.—Kenneth Murray, Sturgis, Mich.

Single Switch Controls Both Lights in Darkroom

In order to eliminate the need of two separate switches to control the bright and red lights of the darkroom, it will be found much handier to use only one switch for the purpose. A two-circuit electrolier snap switch is obtained, the upper half of the contact poles are removed, and the circuits wired according to the diagram. Mount the switch in a position handy when working and you will find this wiring a great time saver. —J. W. Bee, Baltimore, Md.



Electrolier Snap Switch Controls Both Lights in Photographer's Darkroom



This Small Compartment in the Garage Contains a Heater Element to Keep the Motor Warm

Keeping Motor Warm in Cold Garage

It is unnecessary to heat the whole garage in order to keep the motor warm. The drawing shows a simple method of heating a small compartment just large enough to accommodate the hood of the car. A shelf is constructed just high enough for the hood to pass under it. It can be made of wood, wallboard or even large pieces of corrugated board obtained from old cartons. A curtain of heavy canvas, cut to fit over the hood and fenders, is draped in front of the shelf. Inside of the compartment a 250-watt heater element is installed, mounted directly on a porcelain base. A copper reflector is not needed. Provide a switch on the wall in a convenient location. In use, the front of the car is driven under the curtain so that there is little chance for the warm air to escape, and the switch is then turned on. This will keep the chill out of the motor and makes it easy to start.—Dick Cole, Los Angeles, California.

¶ If your wardrobe trunk isn't in use, it makes a handy towel cabinet for the bathroom.

Clothes Rack Attached to Auto Top

This Rack Holds Your Clothes Out of the Way and Prevents Getting Them Wrinkled

When quite a bit of luggage is carried along, as is usually the case on a camping trip, the illustrated rack will be found highly convenient for keeping the clothes, as it utilizes space not otherwise needed. It consists of two sidepieces with thin slats screwed across them to fit inside of the car. Screwhooks are used to hold the rack to the car top as shown. The clothes are neatly laid on the rack and it is then fastened in place. Besides the saving of considerable space, effected by the rack, it has the advantage of keeping the clothes from being wrinkled.—R. W. Calder, Chicago, Ill.

Handy Method of Removing Stamps

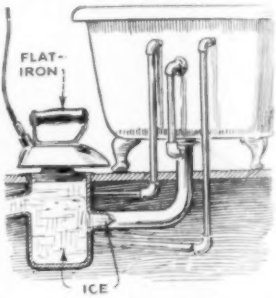
To remove postage stamps from misdirected envelopes, take an empty ink bottle, clean out thoroughly and drill a 1/16-in. hole through the cork. Then fasten a small piece of thick cloth over the cork, cementing it at the edges with waterproof glue. Fill the bottle with warm water, insert the cork, and then place it upside down on the stamp, as shown. In this way just enough water will be fed to the stamp to saturate it, loosening the mucilage so that the stamp can be removed without risk of tearing it.—E. W. Cornell, Adrian, Mich.

Winter Use for the Lawn Roller

Time and energy are saved by making the common lawn roller work when the snow is piled high. This new use for the lawn roller is in keeping sidewalks clear of drifted snow. Immediately after a snow storm, pack down the snow by rolling. The operation requires only a few minutes and gives a smooth, hard surface for walking. This can be continued several times, once after each snowfall. When the packed snow finally reaches too great a thickness it is easily and quickly removed in great chunks with a shovel, and without any great expenditure of effort.

Flatiron Used to Thaw Out Frozen Drain Trap

If it happens that the drain trap of your bathtub freezes, place an electric iron on top of the trap as shown in the drawing, plug the cord into an outlet and await results. It will take only a very short time to melt the ice inside. This method has been found much quicker than pouring boiling water into the drain. Of course, the adjacent pipes carrying waste water will most likely also be frozen and it will take longer to melt the ice in these pipes. The object of using an electric iron for this purpose instead of a blowtorch, is that the trap is usually made of lead and the heat of a torch might melt the lead. If the pipes leading from the trap are accessible in the basement and are not of lead, a torch may be used on them if desired.—H. H. Siegele, Emporia, Kans.



¶ A small art-gum eraser will remove dirt on your fingernails without discomfort.

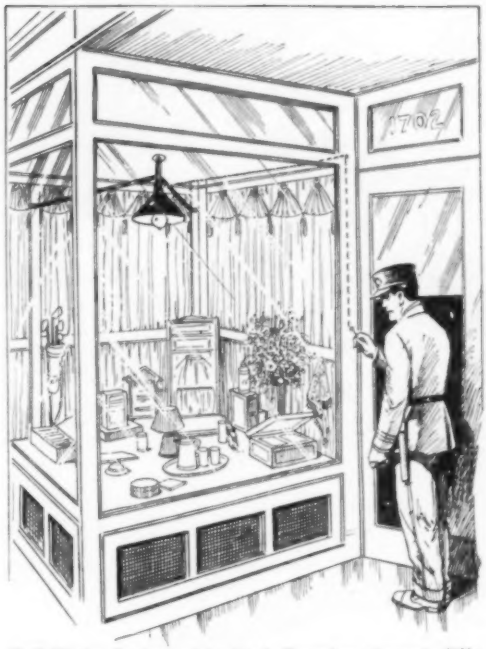
Diver Submerges Only at Master's Will

Holding the bottle in the right hand, the Cartesian diver's master can make him sink or rise, apparently, by moving a finger of the other hand up and down, although the latter does not touch the bottle. The secret is pressure exerted by the right hand on the bottle, which forces a little water up into the inverted vial, thus increasing its displacement, or weight, and causing it to sink. Seemingly a glass bottle will not yield to pressure. However, a flat 16-oz. bottle used by druggists will give slightly, and if the vial is properly balanced the slightest increase in its displacement will make it dive.

A small pill bottle, about 2 in. long, should be filled about three-fourths full of water and inverted in the large bottle. The latter should be filled to the top in this process, and water later poured off until it stands about ½ in. from the bottom of the cork. The small vial should be balanced so that it barely floats. Experiment will determine the correct amount of water required.

The diver can be elaborated by painting the outside, somewhat as shown, with oil paints, and attaching arms and legs cut from thin rubber, and secured with ambroid, or model-airplane cement.

The small vial can be made to dive by pressing gently on the cork of the larger bottle, but this gives the trick away somewhat more quickly than when the pressure is exerted on the bottle sides. When pressure is exerted on the cork, any size of bottle can be used for the container, from a gallon jug down.



Pull-Chain Socket with Cord Running through Window Frame Permits Control from Outside

Store Light Controlled from Outside

Wishing to provide illumination in his store window but not desiring to keep the light burning all night, one store owner installed a pull-chain socket, and a cord attached to it was then run through the window frame so that it could be reached from the outside. In this way the night watchman or policeman can pull the light on and off, or a nocturnal window shopper can satisfy his desire.—William C. Lsonse, Victoria, B. C.

Using Paper Clips in Letters

When mailing letters to which checks or other matter is attached with paper clips, the clip should be so placed that, when the letter is folded, it will be at the bottom of the envelope. The reason for this is that the stamping wheels of the canceling machines often clog if they meet any obstruction, and, as a result, not only the letter is damaged, but usually several following it are badly torn before the operator has time to shut off the small motor which drives the machine. Irregular, very large or bulky letters are post-marked separately with a hand stamp —J. M. Kline, Harlingen, Tex.

"Tumbler Golf" in the Parlor Is an Interesting Pastime When You Can't Play Outdoors

"Tumbler Golf" for Your Parlor

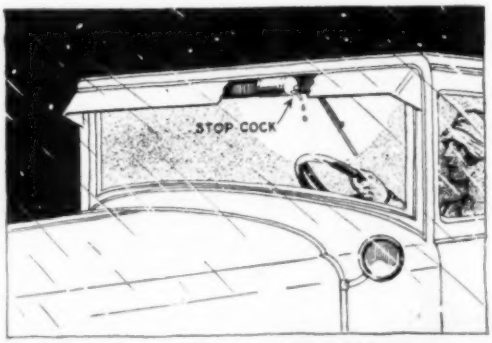
The next time rain keeps you from the greens, or a new diversion must be obtained for a party, try "tumbler golf." It will provide entertainment and good practice. Place an ordinary tumbler at the edge of the parlor carpet or rug. Move the chairs and other obstacles toward the side of the room. Place a standard golf ball 18 in. in front of the opening and try to putt it into the tumbler, giving yourself three chances. If you succeed the first time, credit yourself with three extra shots for the next position, or six shots in all. If you fail the first time and succeed the second, you get but five shots from the second point. With the third failure you are out. After placing the ball from the 18-in. point, you move it to a new position twice as distant away as the first, or 36 in. from the target, and repeat the process. Every time you move to a new position you automatically acquire three chances at the tumbler, plus the number of shots you had left over from previous positions. Thus you may arrive at the other side of the room by increasing the distance each time you move. The player who travels the greatest distance, before using up all of his shots, wins.

Eliminating Pinholes in Castings

In making steel dies with a steel core in order to mold solid-babbitt bearings, there was only .015 in. allowance inside and outside for finishing. When finishing the castings, we found that they were full of small pinholes just under the surface. To get rid of them, both the steel die and core were first heated and then the inside of the die and the outside of the core painted with blue clay, pulverized very fine and mixed with water to a thin paste. This is applied with a small brush to the hot die and core quickly, as it will dry as soon as it touches the hot steel. This paint allows the gases to escape from the metal and eliminates all the holes.—H. K. Ellis, Cincinnati, Ohio.

Alcohol Dripped on Windshield Prevents Ice

By mounting a small tank filled with denatured alcohol on the windshield frame, and leading a slender tube to a position just above the wiper, as shown in the illustration, a small amount of alcohol will run out and the wiper will spread it evenly over the glass, preventing the formation of ice on the windshield. Of course, it is necessary to provide a small valve to control the flow of alcohol. The best method of mounting the tank is to use spring clips so that it will be easy to remove the tank to refill it.



Small Can Supplies Alcohol on Windshield to Prevent Ice Formation

Old Garden Hose Can Be Used as Electric Conduit

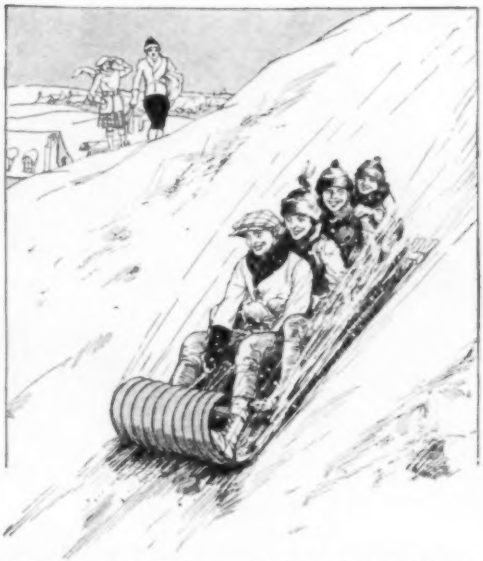
As a substitute for electrical conduit, especially where the wires are to be run for a distance underground, as in providing lighting for rock gardens, etc., odd lengths of old garden hose will be found useful. Such hose, when it is too weak to withstand water pressure, still makes satisfactory moisture-proof insulation for wiring. All cracked and split portions should be wrapped with electricians' tape and will then last for many years. Additional protection can be obtained by coating the hose with any asphaltum base paint. One advantage of this homemade conduit lies in its extreme flexibility.—Harry W. Wyckoff, Monterey, Calif.

Finger Grip Holds Pen Light

The convenient type of flashlight known as the fountain-pen light can be made handier still by the addition of the wire clip shown in the drawing. When one must have a light, yet have both hands free, the clip is slipped over the light and the extensions gripped under the second and third fingers. In this position the light will not be in the way at all nor interfere with the free use of the fingers. On some makes of this type of light, the pocket clip serves as a switch, and in this case it will be necessary to use a rubber band to keep the switch down when in use.—M. L. Harmon, South Bend, Ind.

Coasting Toboggan Made of Corrugated Sheet Steel

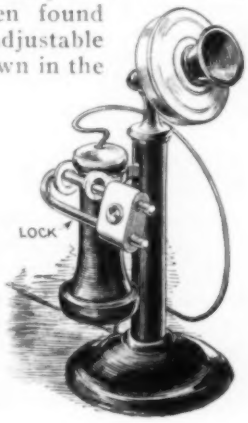
Made of corrugated sheet steel such as is used for roofing, the toboggan shown in the drawing has all the usual requirements for coasting. The corrugations run lengthwise and the front end is bent to the desired curvature, by means of a set of bending rolls at a sheet-metal shop. Hardwood cleats are laid across the width of the sheet, one at each end and two spaced equidistantly between the end ones, and suitable braces are provided between the two front cleats to give the necessary rigidity, which will help greatly to preserve the shape of the sled. To attach the cleats, holes are drilled and countersunk in the sheet steel for flat-head screws, which are driven in from underneath.—A. C. Cole, Chicago, Ill.

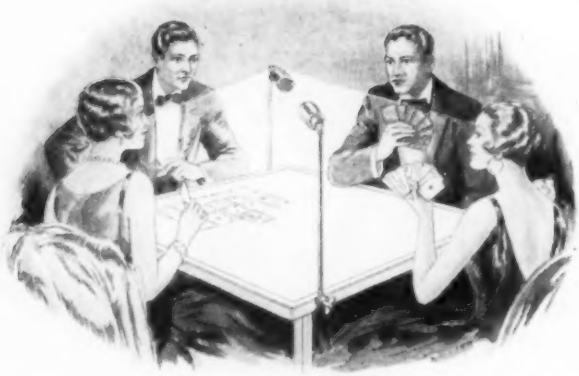


Toboggan Made of Corrugated Sheet Steel and Braced with Hardwood Crosspieces Is Easy to Make

Padlocking the Telephone

There are times when it is desirable to have a lock on the telephone. For this purpose it has been found best to use a small adjustable lock of the kind shown in the illustration. It is passed through the two holes in the receiver hanger so that the latter cannot be removed. The advantage of this method is that it requires no alterations on the telephone.—R. J. Bailie, New York City.





Homemade Fixtures Which Are Attached to Card Table Provide Correct Illumination

Lamps for the Bridge Table

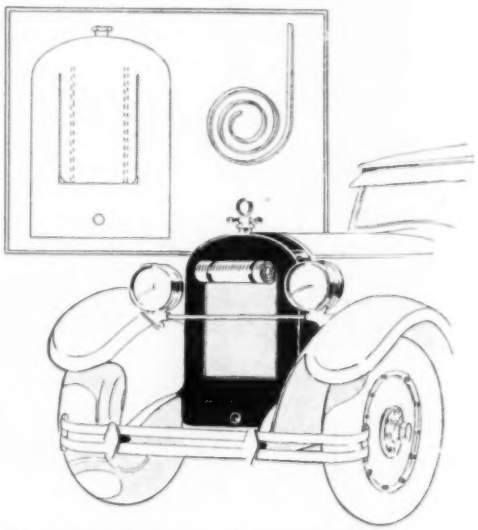
Two lamps attached to the bridge table will be found a convenient source of illumination, an extension cord being provided so that the bridge table can be placed anywhere and the cord plugged in at the nearest outlet. The standards holding the lamps are merely 18-in. lengths of ⅜-in. brass tubing of suitable thickness. Flanges may be provided at the bottom to permit attachment to the table top near the corners or the lower end of the tubing slit open, flattened and drilled to receive a screw for fastening it to the edge of the table as shown. In case flanges are used, a hole is drilled through the table top directly under the end of the tubing for the wire to pass through. At the top end of the tubing an elbow and nipple are used in connection with suitable sockets, which may be of the candelabra or the intermediate type. Small tin cans may be used for shades, although the writer found small automobile ash cups handy for the purpose.—Myron L. Harmon, South Bend, Ind.

Cheap Substitute for Hand Fire Grenade

A quart bottle filled with a saturated solution of ordinary salt water makes a cheap and effective substitute for a fire grenade. When thrown into the midst of a blaze, the bottle breaks and the salt forms a coating on all objects that the water touches, making them nearly incombustible.—Kenneth Keith, Chicago

Hookless Fastener Used on Radiator Cover

Many of the late-model cars are fitted with automatic shutters on the radiator, but even so a padded hood cover has not lost its usefulness when the car stands in the cold for any length of time. I had the padded cover on my car fitted with hookless fasteners on the drop flap so that it could be closed snugly. Originally short straps with snap fasteners held the curtain roll open, but these would often become unfastened and the curtain would fall down, making it necessary to climb out and open it again. In order to overcome this trouble, I fitted two softly coiled flat springs in the hems of the drop curtain as shown in the drawing. The springs were obtained from a discarded toy automobile. Quite unintentionally this arrangement made a semiautomatic shutter. The hookless fasteners held the cover closed when the motor was idle, but as soon as the motor was started, the vibration caused the cover to roll up slowly. So it was not necessary for me to climb out over a snowdrift to open the flap, nor could it close itself while the car was running.—Dick Cole, Los Angeles, Calif.



Coiled Springs Keep the Radiator Cover Open While Hookless Fasteners Keep It Closed

TOPSY-TURVY MATCH IS CLEVER BIT OF MAGIC

"The Quickness of the Hand Deceives the Eye." The Simple Secret of the Mystery of the Topsy-Turvy Match Is an Additional Head, Drilled to Fit the "Dead End" of the Magic Stick

This capital little bit of magical equipment is capable of effects which never fail to puzzle even the most wide-awake people. Here is magic which you can carry around in your vest pocket, yet it is instantly available when a good trick is in order.

The whole apparatus consists of a small metal or cardboard tube, of such proportions as to enable an ordinary safety match to slide through freely. The tube should be a trifle longer than the match. The trick consists in dropping an ordinary match into this tube, head down, yet, upon the tube being lifted, the match is seen to be standing head up!

There is no secret in the tube—the whole trick lies in the match. This has a head at each end, one of which is detachable, being a genuine head of a similar match very carefully hollowed out so that the end of a stick can be temporarily fitted onto it. The hollowing out of the dummy head can be done best by using a small drill in the manner shown in one of the photos. The drill should be worked very slowly, and, even then, it is advisable to hold the match head with a rag to safeguard the fingers against a sudden blaze. Sometimes it is possible to twist the head from a match with the fingers alone, but this does not give a clean pocket as does the drilling method.

Once the dummy head has been drilled out, it is fitted onto the end of an ordinary match, as shown, care being taken, of course, that both heads are the same color.

Several excellent effects are possible with this rather curious match, the "topsy-turvy" effect being the most popular. In performing this number, the match is held between the first finger and thumb of the right hand, the genuine head being uppermost, and completely hidden between the ball of the thumb and first finger. The match is inserted into the tube in such a way that the genuine head is covered right up to the last. When finally dropped, the waiting finger and thumb of the left hand grip the dummy head in precisely the same manner as the right hand originally concealed the real head, and the cover being removed, the match is seen to

Dropping the Match into the Mysterious Tube Which Makes It, Apparently, Stand on Its Head; Inset, Match Ready for Action

be reversed entirely. In drawing it from the left hand for inspection, the false head is left between the thumb and finger. A little study will soon show you that the tube can then be transferred back to the left hand, and the two, tube and dummy head, quite naturally placed in your most convenient pocket.

Another excellent effect with the same equipment is the "match reincarnation" number, although this effect destroys the dummy head. In effect, the head is cut from an ordinary match, and the headless stick is then wrapped in a piece of paper. The head is burned, and the ashes sprinkled on the paper. On opening the packet, the match is found to be quite normal, with head in place. The secret, of course, is the same as in the previous number. The real head is held by the fingers, and it is the removable head which is burned.

An Improved Potato Bin

Much of the dirt that usually accumulates in a potato bin, and also most of the loss caused by rot and sprouting, can be eliminated if the bin is built a bit differently. Ordinarily, potatoes are merely tossed into a bin and those at the bottom have very little chance of getting any ventilation. Therefore, the bin should be constructed with an inclined bottom and an opening should be provided along the lower side. In this way the potatoes on the bottom will be used first. Furthermore, as the potatoes roll down the inclined bottom they will turn over so that the air circulates freely among them. The bin should be built with large slots in three sides. The back side may be tight. At the side where the opening is, a rail should be built so that the potatoes will not roll on the floor.

Clothespin Bag Hangs on Line

In order to have a clothespin bag convenient where it will always be in reach, make it adaptable to be hung on the line as shown in the drawing. It consists of an ordinary clothes hanger and a small pillow case, meal bag or other cloth bag that will fit on the hanger. A hole cut in the side, with the edges neatly sewed over, makes it easy to insert or remove the pins. The bag is easily pushed along the line.—Jos. C. Coyle, Englewood, Colorado.

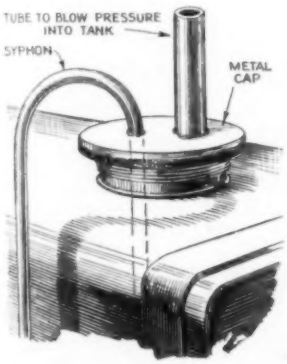
Clothes Hanger and Small Bag Make a Handy Clothespin Holder

Correct Water Level in Cooling Tank Prevents Souring of Milk

Forty-two years of dairying and not one can of milk sour during the last thirty-five years, is the record of William Knobloch, veteran dairyman of Arthur, Ill. He never uses ice to keep the milk cool, but depends on the water in his cooling tank. Prior to 1895 he frequently experienced having his milk sour in the cans, but noticed that the cream on top of the milk soured first. As a result of this observation he began filling the cans only three-quarters full in order to have the cream below the water line of the cooling tank. When this plan was put into effect the trouble was completely eliminated.

Blowing into the Tank Starts This Siphon

Taking advantage of the fact that the gasoline tank is airtight if the cap is fitted with a gasket, it is an easy matter to start a siphon by blowing through a tube soldered to an extra cap, which is carried along for the purpose. The cap is also drilled for the siphon tube itself, as shown in the illustration. Use a rubber or cork gasket, screw the extra cap on the filling spout tightly and blow into the first length of tubing, which should be about ½ in. in diameter. The siphon tube should extend nearly to the bottom of the tank so that it will be possible to remove almost all the gasoline.



Old Mop under the Wheels of an Auto Gives Traction

A new use for an old mop has been discovered by drivers for a large taxicab company. With the handle cut down to a few inches, the mop is carried in the tool kit and, when slipped under a rear wheel, gives the bit of traction needed to get out of a slippery hole.

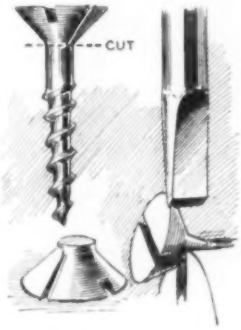
Bed Covers Can Be Kept off Injured and Tired Feet with This Wooden Frame

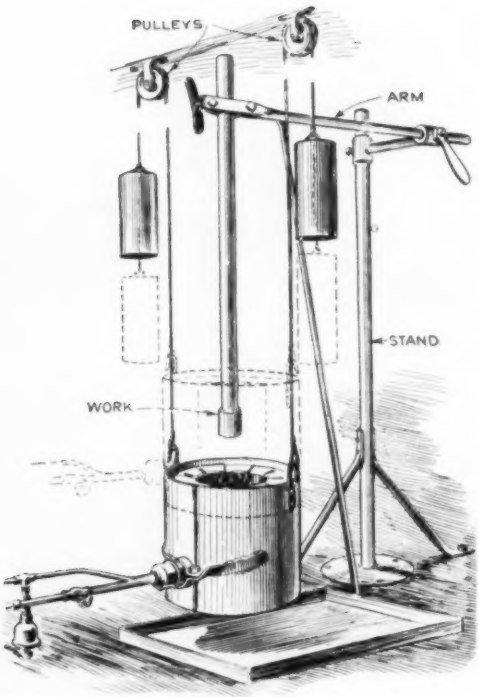
Frame Keeps Covers off Injured Foot

Anyone who has spent some time in bed with an injured foot will appreciate a device that keeps the covers off the foot and thus relieves it of considerable pressure. Get two 1-in. boards sawed to a semicircular shape with slots cut in each so that they will fit each other crosswise. No nailing is necessary.—W. H. Martin, San Antonio, Texas.

Improvised Countersink

On a cabinet job away from the shop it was necessary to use a countersink and as none was available, the emergency method shown here was resorted to. The head of a flathead screw was cut off and a cut made on its edge, raising a sharp burr to act as a cutting edge when the head was inserted in the hole and turned by a screwdriver, countersinking the holes.





Small Brazing Furnace Suspended from Pulleys Is Adjustable to Suit the Work

Adjustable Brazing Furnace

In brazing collars on copper piping in a Denver plant it was found practical to suspend the brazing furnace from small wire cables, passing them over 4-in. pulleys attached to the ceiling and provided with suitable counterweights. The pot is made of ⅛-in. sheet metal with a hook welded to each side near the top, and lined with fire brick. A hole is drilled through the bottom for a length of pipe and the gas burner is inserted near the bottom. The pipe to be brazed is clamped vertically in the arm of a simple stand, made of old pipe, and the brazing furnace is raised up to the collar while used.—J. C. Coyle, Denver, Colo.

Large Dial Fitted to Small Clock

A large clock with a face about 2 ft. in diameter, was constructed by using a dollar alarm clock to operate the hands. The glass and hands were first removed from the clock and brass extension tubes were provided on the posts of the hour and minute hands. These extension tubes give the necessary projection through the large clock face to accommodate the large hands. Each tube should be snugly fitted to the post, one inside of the other, and the inner tube must be longer than the outer one. For the face cut a disk of sheet metal about 2 ft. in diameter. Paint it white and letter the hour figures in black or, if desired, the face can be painted black and the figures applied with radium paint. Directly behind the disk fasten the clock by means of suitable screws. The large hands should be cut from sheet aluminum and are drilled to fit snugly on the ends of the tubing.

Paper Roll Supplies Continuous Bench Covering

Keeping a small workbench top clean is an easy matter with the arrangement shown in the drawing. Two brackets for holding a roll of kraft paper are screwed securely to the left end of the bench and two brass guards at either end hold the paper flat. When the bench needs recovering, tear off the soiled piece and pull out a new section of paper. It is not necessary to purchase complete rolls of paper; just go to a merchant who uses heavy wrapping paper and obtain a few

Roll of Kraft Paper Makes It Easy to Keep the Bench Cover Clean

remnants containing 40 or 50 ft. of paper. —Earle M. Guild, Attleboro, Mass.

Using Stoplight for Backing Light

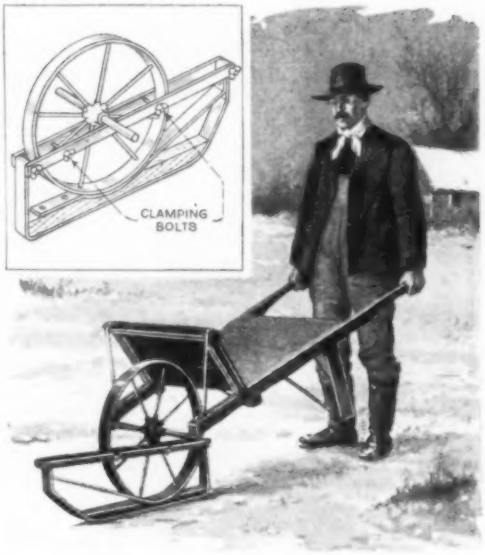
The late design of rear lamps on the model-A Ford has a yellow lens for the stop signal. This projects a powerful beam behind, which is very useful when backing at night. A single-hole pull or toggle switch, placed on the dash, makes it easy to turn the light on when needed. One wire from the switch is run under the gasoline tank and into the terminal box on the dash, the other wire being led through a small hole in the dash, on the left side, and then back with the standard wires to the stoplight switch. Armored wire with heavy insulation should be used for the purpose.

Lantern in Barrel Prevents Hydrant from Freezing

Outside hydrants can be protected against frost by simply placing a keg or barrel over them and placing a lighted lantern inside, as shown in the drawing. To provide proper ventilation for the lantern, drill two holes in the bottom of the keg and insert pipes as shown. The lower outlet of the intake pipe should be near the ground level, while the lower opening on the other pipe should be a foot higher, to insure circulation. Elbows and nipples at upper ends of the pipes prevent snow and rain from entering.—James F. Hobart, Dunedin, Fla.

Runner for the Wheelbarrow

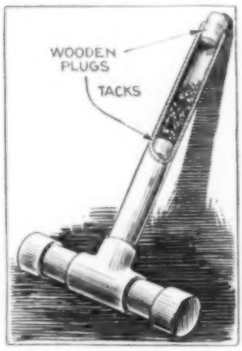
By applying a runner to the wheelbarrow, it will be much handier to use during winter, especially when it is necessary to push it through loose snow. It consists of a piece of wood a trifle wider than the wheel rim or tire. To this runner a length of flat iron of the same width is attached, leaving both ends projecting, after which the ends are bent upward and eyes formed to accommodate bolts. Two pieces of flat iron, drilled the same size as the eyes, are then used as crosspieces to provide the necessary rigidity. An extra length of flat iron, the same size as the runner, is then bent and attached to form a seat for the wheel. Besides using bolts with wingnuts at the ends of the crosspieces, two additional bolts are used to clamp them onto the wheel.



Runner Applied to the Wheel Makes a Wheelbarrow Easier to Use during Winter

Hammer Made of Pipe Holds Supply of Tacks

Made of pipe and fittings, the handy hammer shown in the illustration holds a large supply of tacks, ready for use when needed. The caps used on the head are ground to a flat surface and a wooden plug is driven into the handle so that the tacks will not get into the head. Another wooden plug is used to close the open end of the handle.—W. D. Cockburn, Woodstock, Can.



Mirror Placed under Photo Gives the Illusion of Water into Which Bathers Seem to Leap

Trick Photograph Made with Mirror

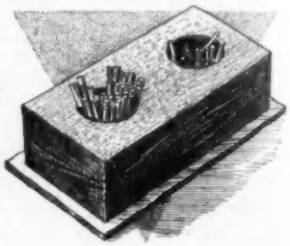
Apparently leaping into a deep pool and caught by the camera in mid-air, the trio of bathers make an interesting photograph, especially as there was no water within sight when the photo was taken. The upper half of the picture is a truthful reproduction but was "shot" on the lawn. When making an enlargement, a mirror was laid on a table, and the photo, trimmed down just below the slight rise in the ground, was placed on the mirror. The reflection of the photo in the mirror gives the illusion of water.

Breaking In Stringed Instruments

By placing new, stringed instruments close to a radio loud speaker, it is possible to break them in effectively, thus greatly improving their tone quality. A violin already broken in is quite expensive, and this method enables anyone to purchase a cheaper instrument and break it in himself. Tune the instrument properly and set it on a shelf directly in front of the loud speaker, or if this is impossible, on the shelf that holds the speaker. Perhaps there is enough space in the radio cabinet to hold the instrument or else it can be laid on top of the cabinet. The vibrations of the loud speaker are transmitted to the instrument, which responds in what is called a "sympathetic vibration." After a few weeks of such treatment the instrument will be found to have a much better tone than at first. It is advisable to retune the strings every few days. Some instruments, such as cellos, bass viols and even violas, require a good dynamic loud speaker to age them as described above, as an ordinary magnetic speaker does not deliver the low tones possible with a dynamic. The longer you break the instruments in the better the tone quality will be. If a guitar is kept on the same shelf as the speaker, the tone of the instrument seems to improve from month to month.

Brick Makes Handy Match Holder

A face brick, having two holes through the core as shown, makes a good match holder for the office desk, one hole being used for live matches and the other for those already used. The brick is set on a piece of linoleum or other similar material, cut slightly larger than the brick. The rough surface of the brick makes a good striker that never wears out. It can be given an application of gold bronze to make it more attractive, and may be used also as a cigaret holder. —John G. Hanna, Dunedin, Fla.



Making Band-Inlay Strips

By W. CLYDE LAMMEY

THOUGH inlay strips, commonly known as "bandings," are obtainable commercially, it is often desirable or necessary that we have a special form, length, or width that cannot be purchased ready-made, or that cannot be obtained quickly enough to suit. Though an inlaid band appears to be a difficult piece of work, it is comparatively easy to make where one has at hand a small saw table on which the parts can be accurately cut to size. A built-up block from which about a dozen thin inlay strips may be cut, all of the same figure, can be made in a few minutes. Figs. 1 and 2 show a number of designs which can be made without becoming involved in an intricate process. If the woods are carefully selected and cut accurately to size, the result is a highly colored band that will inlay beautifully, and suitable fancy woods in a wide range of quality, size and thickness are more easily obtained than the made-up bands.

The design shown at A, Fig. 1, is made up of two woods, 1/8-in. ebony and 1/16-in. white-holly veneer. First the stock must be carefully selected for uniformity, and one edge jointed true. To joint the holly, the edge of the piece must be clamped between two supporting strips, locked in the bench vise and planed off by hand. The ebony strip may be jointed either by hand or with the small power jointer. If the throat opening in the saw table is wider than 1/4 in., it will be necessary to make a new throat block of wood with an opening of about 3/16 in.

The width of the built-up block from which the inlay strips are to be cut depends on the amount of inlay in the design required. If the block is 3 in. wide

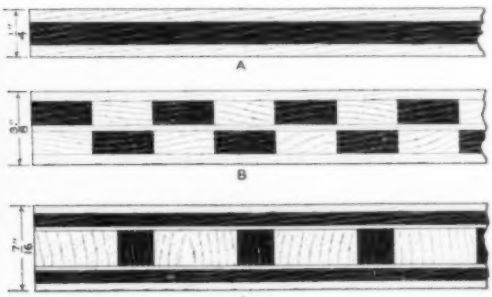


FIG. 1

Cutting the Ends of the Mitered Core Blocks for the Design Shown in D, Fig. 2; Right, Several Simple Banding Designs

and 24 in. long and the inlay bands are ripped to ⅛-in. width, then, allowing 1/16 in. on each piece for the saw kerf and an additional ⅛ in. for inconsistencies in width, we can cut fifteen inlay strips from the single built-up block, or 30 ft. in all.

Assuming that this is the amount required, rip two strips from the holly, each 3 in. wide and 24 in. long. Rip one strip from the ebony stock the same width and length as the holly strips. Get two pieces of hardwood, each piece about 26-in. length and 3½-in. width, for use as clamping cauls. Glue the three strips together as shown, with a liberal coating of glue. Place the work between the cauls and draw very tight with six heavy C-clamps, evenly spaced. When dry, remove the clamps and joint one edge of the work. Then place this edge against the ripping fence of the saw and rip the strips to ⅛-in. thickness as needed. Use a "planer" saw blade if possible when ripping the block into strips, or at least a saw blade with a very fine set.

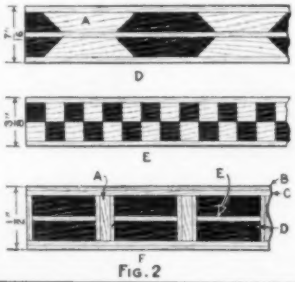
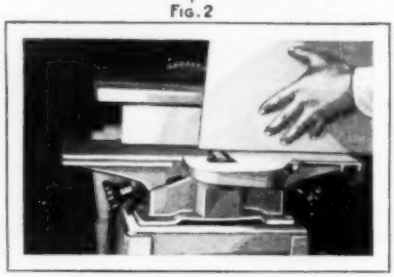


FIG. 2



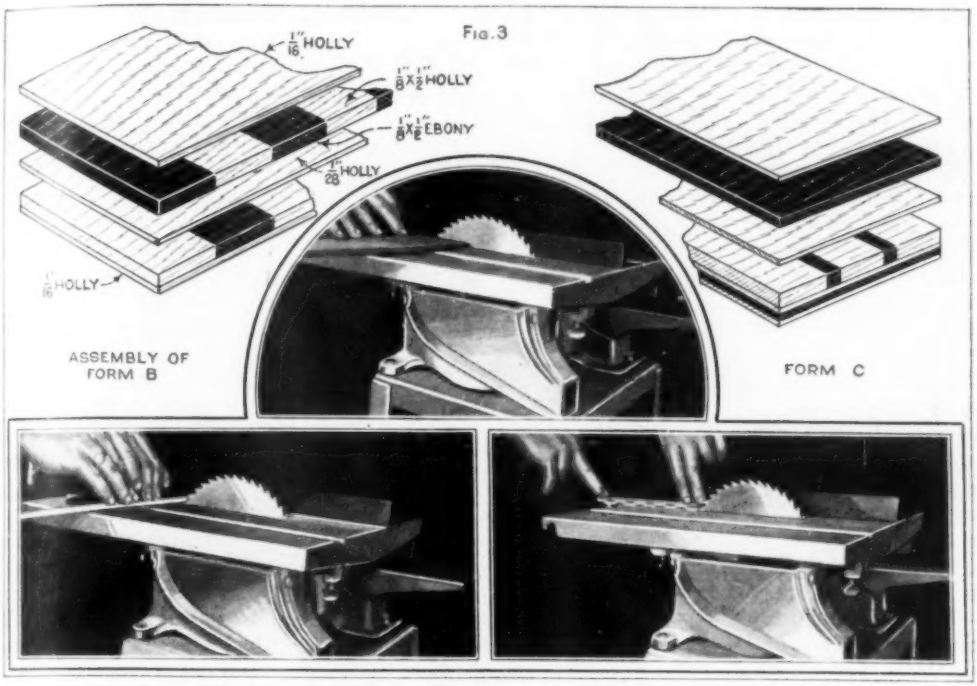
Three More Elaborate Banding Designs; Below, Jointing the Edge of the Built-Up Stock before Ripping

The second design, B, is a more elaborate form. The core of this design consists of alternate strips of ebony and white holly, ⅛ in. thick, with a 1/28-in. veneer of holly between. The holly and ebony core stock is cut across the grain into strips ½-in. width and 3-in. length and is laid crosswise. The drawing of form B in Fig. 3 shows clearly how the core is assembled between the 1/16-in. facing strips of holly. For a built-up block, 24 in. long, 48 pieces of holly, cut to ½-in. width, and the same number of ebony will be needed, both ⅛ in. thick and 3 in. wide. These may be cut by first ripping the stock into 3-in. strips, then setting the ripping fence just ½ in. from the saw, and using the fence as a stop to gauge the length of each piece cut. Assemble in the manner shown in Fig. 3. Be very careful that the small pieces which make up the core are correctly placed and that they do not shift when the work is glued and clamped.

Design C, Figs. 1 and 3, is an ornate band for a large ground. The top and bottom are first built up as separate units in the same way as design A, save that the core is 1/16-in. ebony or amaranth and the facing strips 1/28-in. holly. Glue up and clamp both facing strips at once, placing a sheet of paper between them so that they do not stick together. The core of the finished inlay is made up of ⅛ by ⅜-in. pieces cut across the grain from ⅜-in. amaranth, and alternated with ⅛ by ⅛-in. ebony squares, also sawed across the grain. The manner of building the inlay block is clearly shown in Fig. 3. When sawing the small parts, use a saw blade with very little set and bring up the ripping fence as a stop to gauge the length. When ripping off the inlay bands from these more complicated patterns it is necessary to be very careful that the band does not break up. It should be held firmly and moved slowly against the saw.

Pattern D, Fig. 2, looks especially well when inlaid vertically. Its construction is essentially the same as that at B, save that the parts of the core are cut at an angle of 45 degrees at the ends and are laid opposite, two of the same color, with a thin strip of holly between. The light-colored blocks, A, are cut from boxwood and these as well as the ebony blocks may be cut from either ⅛ or ¼-in. stock. When the blocks are cut from ¼-in. stock the finished band will be about 11/16 in. wide.

The parts are first ripped to 3-in. width. The saw table is then tilted to 45 degrees and the ripping fence set ½ in. from the saw if the stock is ⅛-in. thickness; if ¼-in., then set the fence ¾ in. from the blade. Be particular about the setting and do not change it until all the pieces have been cut. Miter one end of the piece



Center Photo, **Cutting Off Ebony Core Stock to Width; Left, Sawing Off Vertical Cores for Design F, and Right, Ripping a Finished Block, Design B, to Thickness for Bands**

first, then turn it over and slide the mitered end against the ripping fence, and so on until the required number has been cut. Use a narrow strip to push the pieces clear of the blade when they have been cut off. Then assemble the parts as in Fig. 2 and clamp in the same manner as described for those preceding.

Pattern E, Fig. 2, is similar to design B, save that the center strip of the core is omitted and, instead of being rectangular, the core blocks are square. These may be either 1/8 or 1/4 in. square with 1/16-in. facing strips, according to the width of the inlay band desired. Otherwise the procedure is essentially the same as that described in making design B.

The last pattern, F, in Fig. 1, is somewhat more elaborate. The vertical core blocks, A, are first built up and consist of three members, an outer facing of 1/28-in. holly veneer strips over a core of either amaranth or tulip, 1/8 in. thick. Blocks D are black ebony, 1/8 in. thick and 3/4 in. long. With a center strip, E, of 1/28-in. thickness, the length of the vertical blocks, A must be very slightly less than 9/32 in., but owing to the glue films between, it will be safe to cut these to exactly 9/32-in. length. Hence the part A is first built up as a three-ply strip, the grain of the core running in the direction indicated on the blocks to a width of 3 in. Then the blocks are cut off to the length of 9/32 in.

The center core, consisting of parts D and E, is glued up to 3-in. width, the facings of 1/8-in. black ebony over a center core of 1/28-in. holly. This is sawed into rectangular blocks 3/4 in. long. The complete core is then assembled in the form shown in F, with two facing strips on each side, strip C being cut from 1/16-in. boxwood and strip B from 1/20-in. holly. The gluing and clamping is done in the same manner described before.

The thicknesses given on the patterns A, B, C, D, E and F are only approximate as the woods are sometimes slightly off the exact dimension in thickness. For this reason it is necessary when inlaying to be extremely careful about the width of the groove in which the band is to be inlaid. Where the groove is cut with the dado on the power saw, first test the setting of the head on a piece of waste. If the groove is slightly too narrow, place thin

paper shims over the saw spindle and between the cutters of the head, and try again. Make sure that the head is carefully tightened after the paper shims are added. Make trial grooves in the waste, either taking out or inserting more shims between the cutters of the head, until the inlay band is a light fit in the groove so that it will not be necessary to force it unduly when inlaying. Handle the thin strips carefully and avoid bending or dropping them. Rough handling will break up the pattern.

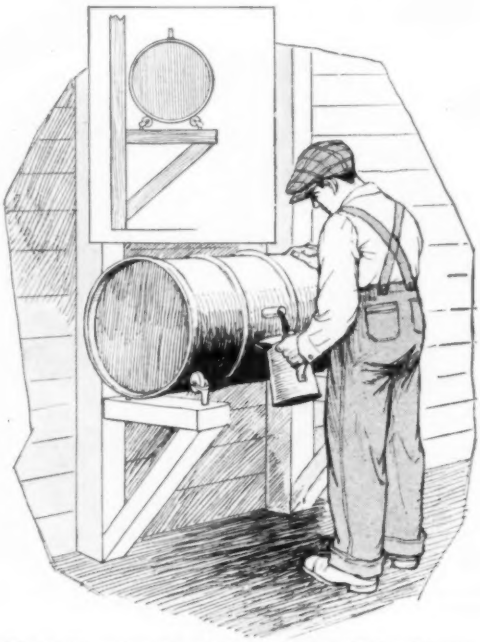
When finishing, do not sand the inlay band, especially if the parts of the core are black ebony, as the sanding will work the black dust into the lighter wood. It is best not to sand any inlay composed of several highly colored woods, for this reason. Always finish with a sharp cabinet scraper, and blow off the dust; do not rub it off. Even when a brush is used, some of the dust will be worked into the lighter wood.

It will be noted that on all the patterns the facings are white holly. For this reason the bands are suitable only for inlaying on a ground of dark color, such as walnut. Where it is desired to inlay the band on a light-colored ground, the facing strips should be a wood of reddish coloring, such as amaranth or vermilion. All these woods are readily obtainable and one can get a considerable selection of the thicknesses required at nominal cost.

¶The more absorbent woods require a priming coat that is rich in linseed oil, with a small amount of turpentine added; while the less absorbent woods need less oil but more turpentine to help the oil penetrate the wood.

Oil-Drum Mounting for Garage

The illustration shows a cheap and simple way to mount an oil drum in the home garage. In my own case, I mounted the brackets on the wall, since my garage was a frame structure, but in a brick garage the drum can be mounted on a floor stand. Four old bed casters are used as rollers for the drum. A 1¼ by 6-in. nipple replaces the side screw bung in the drum, and this is covered by a tire-patch container when the drum is not in use. To draw off oil, all that is necessary is to remove the cover and, using the nipple spout as a handle, roll the drum forward until the oil runs freely. When the container is filled, the drum is rolled back.—N. G. Hall, Port Angeles, Wash.



Simple Mounting for 15-Gal. Oil Drum Makes Dispensing Easy and Prevents Waste

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Hose Holder Offsets Danger of Carrying an Ice Pick

Carrying an ice pick in one's pocket, as is common practice, is more or less dangerous. A practical method of carrying it without this objection is shown in the accompanying photo. Get a length of old garden hose that will fit snugly in the rule pocket of your overalls. Slit the top end of the hose so that the handle of the ice pick will wedge into it

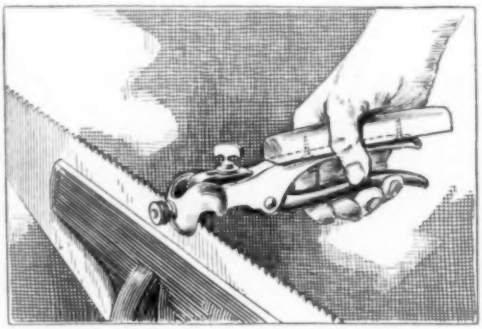
to hold it in place securely. The point will then be inside the hose where it can do no harm.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

Photographic Reflector Easy to Make

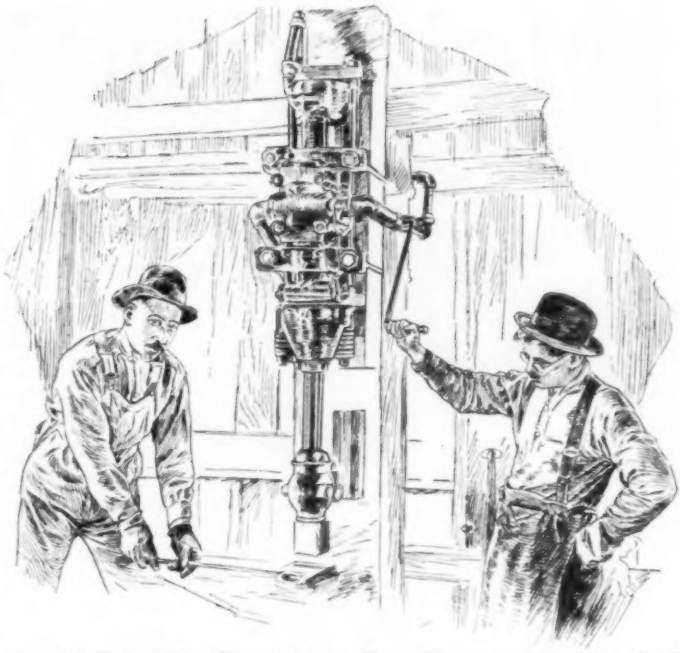
A cheap and quickly made reflector for taking interior portraits, etc., can be made in a few minutes, and has many advantages over the regular white cheesecloth reflectors generally used for the purpose. Get a piece of heavy cardboard or wallboard of the dimensions of the reflector desired, and some large sheets of ordinary tinfoil, such as are commonly used to wrap 8 by 10-in. plates. Coat the cardboard on one side with glue and spread the tinfoil over the coated surface, being careful to leave it slightly crumpled. Do not smooth it out evenly. If smoothed, the tinfoil reflection is too concentrated and brilliant, but when slightly crumpled the foil gives thousands of tiny reflections.

Extra Handle Increases Comfort in Using a Saw Set

When compressed, the handles of the usual saw set are so close together that it is rather tiring on the hand to use it. This trouble was eliminated by attaching a piece of wood to one of the handles. Two holes were drilled through one handle and wood screws were then driven into the wooden grip from the inside. Of course, the extension should be cut and sanded perfectly smooth.—G. M. Beerbower, Hollywood, Fla.



Extra Grip Attached to Handle of Saw Set Makes It Easier to Use



Tripod Drill That Was Converted into a Power Hammer and Used in a Small Shop for Making Small Forgings

Converting a Tripod Drill into a Power Hammer

In a small shop, a large number of light forgings were being made out of ¾-in. round stock by hand, which was rather slow. To speed up the work, a large tripod drill, that had been used for drilling grout holes in a power-dam foundation, was converted into a power hammer. This was accomplished by clamping the drill to an upright post that was imbedded firmly into a concrete base having an anvil block independent of the post, onto which the anvil dies were clamped. The rotating device was removed, a guide provided for the upright post and a bar clamped to the piston head, keeping the hammer die in the ram in alinement with the bottom dies in the anvil block. By using special swaging dies of different sizes, a wide range of forge work can be accomplished.

Making a Pair of

By L·D·Perry

THE craftsman will find no handwork more fascinating and interesting than the making of artistic articles of copper or brass. After a little preliminary experience with these metals the worker will be surprised by the ease with which fine articles may be produced. Little equipment is actually needed other than the usual tools found in the small workshop.

Copper and brass are sold by the pound, and the dealer will cut the metal to any size required for a slight extra charge. For the book ends described here No. 18 and 20 gauge are specified. The 18-gauge metal is the thicker and is necessary to use in the ends to assure proper support for the books. The 20-gauge stuff is used for the designed pieces to be riveted or "appliqued" to the ends, as indicated in Fig. 1. A slightly thinner gauge may be used for these if the workman happens to have such metal. Rivets may be of either brass or copper, the latter preferred.

The first operation is to make a pattern for the ends. This is done as illustrated in Fig. 3. A piece of fairly stiff, tough paper is folded once. One half of the pattern is drawn upon it, the dimensions being taken from Figs. 1 and 3. The pattern is then cut out with a pair of scissors.

The design for the appliqued pieces is drawn next. A piece of tough paper is folded once and the squared lines are drawn

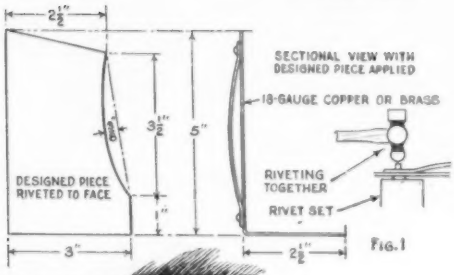


FIG. 1

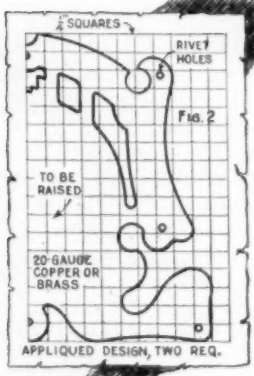
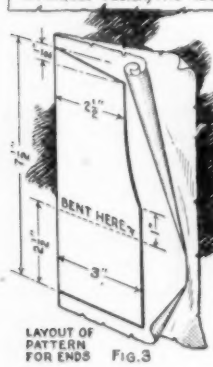


FIG. 2



LAYOUT OF PATTERN FOR ENDS FIG. 3

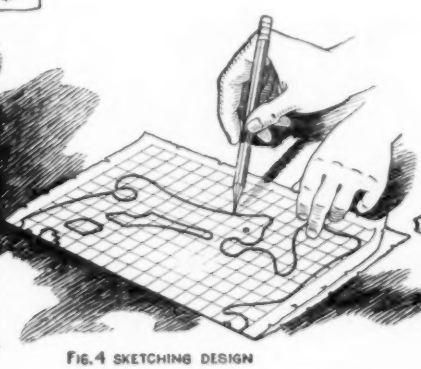


FIG. 4 SKETCHING DESIGN

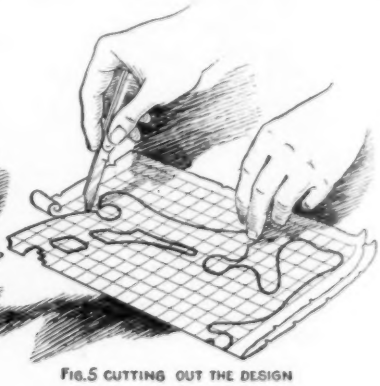
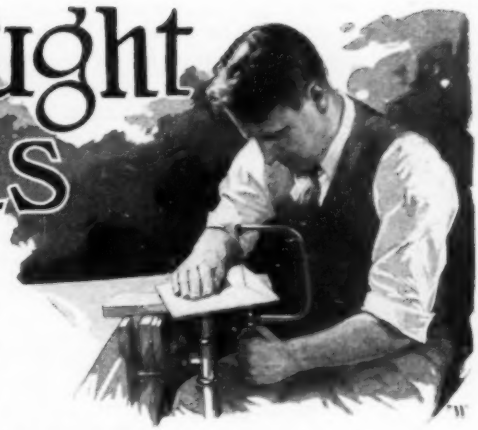


FIG. 5 CUTTING OUT THE DESIGN

Hand-Wrought Book Ends



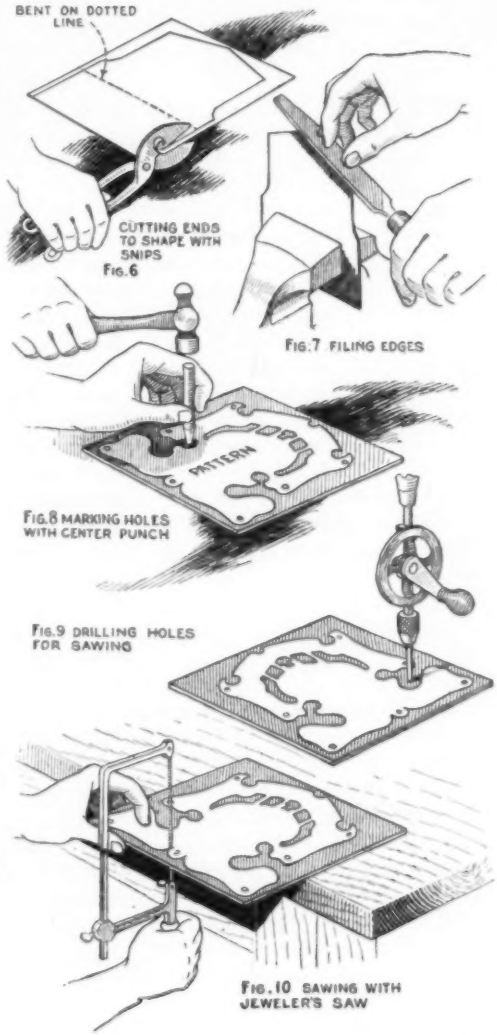
upon it as shown in Fig. 4. The design from Fig. 2 is reproduced on these squares, or an original design may be substituted, then cut out, as shown in Fig. 5, with a sharp pocket or sloyd knife. The paper should be laid over a soft-wood block, or hard paper, so that the cuts are made clean and sharp. A duplicate design should be made from the original and trimmed in the same way. The back pattern and the duplicate designs are now ready for use when the metal is prepared for them.

Two pieces of No. 18 gauge metal are next cut for the ends. These should be a little larger than the pattern, and are smoothed out by striking a series of blows with a mallet. To do this, each piece is laid upon an anvil, iron block or level bench top. When they are trued up, the pattern is laid upon each and the outline is penciled or scratched on the metal. The outline is then closely followed with the tinners' snips, shearing away all excess metal. This process is shown in Fig. 6.

The pieces are again smoothed out, placed in the vise and the edges are filed down to the line with a smooth file. The file should be operated in the direction of the edge, as shown in Fig. 7, not crosswise. Should the vise have rough faces on the jaws, it is necessary to protect the metal with wood blocks, for scratches and abrasions are very difficult to remove.

Next the pieces for the design are cut and smoothed with the mallet. One side of each paper design is coated with very thin glue, and glued to the metal. The paper should be pressed down firmly and allowed to dry, then the rivet holes and the piercings are marked with a center punch, Fig. 8. These marks prevent the drill from "traveling" over the metal and thus making unsightly marks.

The holes are next drilled with a hand



CUTTING ENDS TO SHAPE WITH SNIPS
FIG. 6

FIG. 7 FILING EDGES

FIG. 8 MARKING HOLES WITH CENTER PUNCH

FIG. 9 DRILLING HOLES FOR SAWING

FIG. 10 SAWING WITH JEWELER'S SAW

drill as shown in Fig. 9, or on a drill press, if one is available. The size of the drill to use is determined by the size of the interior cuts or piercings. In no case is a drill larger than ⅛ in. required. In this particular pattern the same drill as used for the rivet holes may be used for the others. Rivets should fit the holes snugly. They should be tried out on a scrap piece to be sure that a drill of the right size is selected.

The design is next cut out with a jewelers' saw. Curved snips can be used for part of the outline but practically all will need to be done with the saw. Fig. 10 shows how the operation is performed. One end of the saw is fastened in the frame with the teeth pointing down and away from the frame. Cutting is done on the downstroke. The frame is adjustable so that when the other end of the saw is fastened with the setscrew it may be given the right tension by an adjustment of the setscrew at the rear of the frame. The beginner will probably break a number of saws until he learns the "feel" of the operation, and takes easy, steady strokes, and learns how to continue to saw as he turns sharp corners.

On the interior cuts one end of the saw is first fastened to the frame, the saw is then passed through one of the holes, and the other end is held by the setscrew or clamp. When the cut is finished, one end is released, inserted in another hole, and sawing continued. When all sawing has been completed, each piece in turn is held in a vise or against the bench top and the edges are filed with needle-point files, as shown in Fig. 11. These files are very fine and come in sets of assorted shapes. A file should be used which conforms to the outline of the part of the design to be filed. Any burrs on rivet holes which may have been left from drilling should be removed with emery cloth.

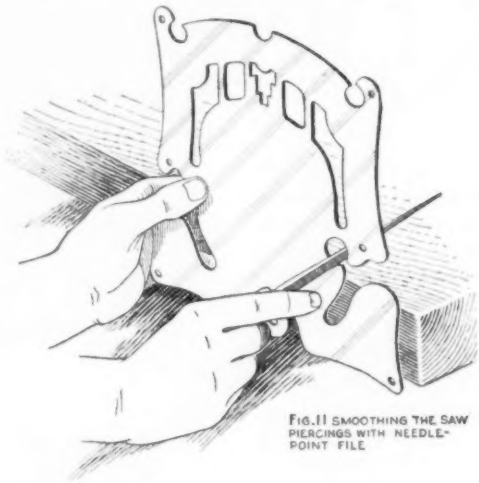


FIG. 11 SMOOTHING THE SAW PIERCINGS WITH NEEDLE-POINT FILE

The paper is now removed by soaking the pieces in water. The center area of the design is raised slightly or "domed," as the process is called. This gives a certain character to the book ends and makes them much more effective in appearance than if the design were left flat. This is done by placing the design on a sandbag, Fig. 12, and striking the parts to be raised with a round-nosed mallet. Do not raise them too much; only about as shown in Fig. 1. The pieces are finally flattened out around the edges by placing each on an iron block and striking with a mallet, as shown at Fig. 13.

The ends and the designed pieces are now ready to be riveted together, Fig. 14 showing how this is done. First the designed piece is placed on the end in the right position and the rivet holes on the lower piece are marked through the holes of the designed piece, then drilled. When the rivet, as shown in Fig. 14, has been driven through both pieces, the end is clipped off fairly close with side-cutting pliers and is then "set" by placing the head in the depression in the rivet set and hammering over the end. When finished, the place of setting should barely show. When all the rivets have been placed and set, the ends will then appear as in Fig. 15.

The right-angle bend for the support of books is made over the edge of the bench or anvil. It is then made fairly sharp by striking with a mallet against a sharp corner.

The completed ends are cleaned by immersion for a few minutes in a solution known to the art-metal worker as "pickle." This solution is made of one part sulphuric acid and fifteen parts water. It should be kept in a crockery jar. The articles should be thoroughly rinsed after they have been taken out of the pickle, preferably in running water. They may

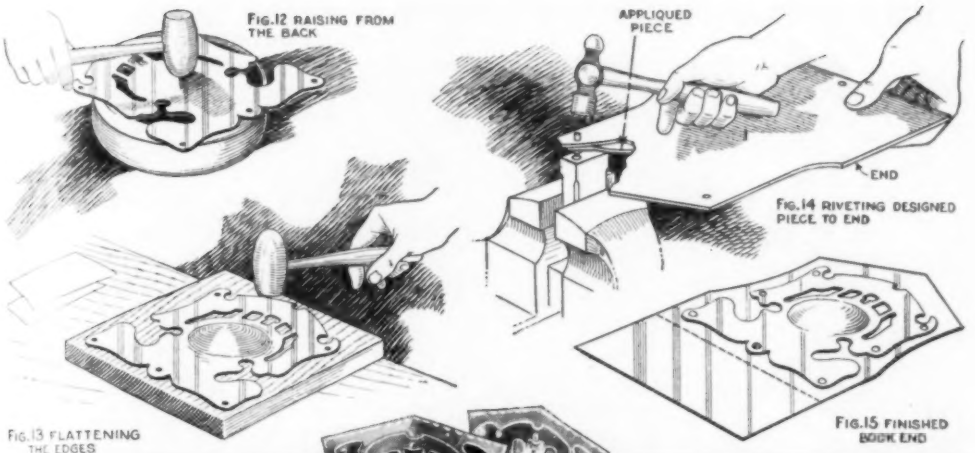
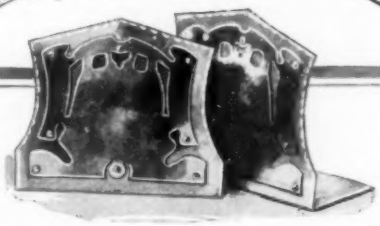


FIG. 12 RAISING FROM THE BACK

FIG. 14 RIVETING DESIGNED PIECE TO END

FIG. 13 FLATTENING THE EDGES

FIG. 15 FINISHED BOOK END



then be quickly dried by placing them in clean sawdust. Before a finish is applied, the metal should be scoured, in one direction only, with a fine grade of emery cloth or steel wool. The finish will be unsatisfactory unless the metal is perfectly clean, and free from oil and grease and even fingermarks.

Copper and brass may be finished bright and allowed to assume the color that comes through exposure to the air, but normally some finish should be applied. One of the simplest and most effective methods of coloring copper is through the application of heat. After the article of copper has been cleaned, it is passed slowly over a gas flame or Bunsen burner, until the colors appear. Different colors appear as the temperature of the copper increases. In order, the following colors appear: orange-red, purple, brassy, dark red, dark purple, and chestnut. The article should be removed from the flame at the right time and allowed to cool slowly. If the color is not satisfactory, the copper may be cleaned in the pickle again and the heat treatment continued until the color is satisfactory.

Oxidized-copper effects may be produced by painting on the following solution with a soft brush: a small lump of potassium sulphide dissolved in 1 pt. of water to which is added six drops of ammonia. If the color is too dark more water is added to the solution. Antique effects on brass are produced by applying butter of antimony and allowing it to dry. For dull brass, apply the following solution with a brush: 12 parts of hydrochloric acid and 1 part ferric oxide. To produce a green color on brass, immerse the article in the following solution: ½ lb. sal ammoniac and ½ lb. sulphate of copper dissolved in 2 qt. boiling water.

Colors produced by any of the solutions mentioned and by heat are not permanent unless protected with some finishing agent. Wax may be applied while the metal is warm, and after it has cooled, it is polished by brisk rubbing with a soft cloth. Lacquer also is a good finish. It is applied very thin with a soft brush and allowed to dry.

Ford Valve Guide Removes Carbon from Valve Stems

An old discarded valve guide from a model-A Ford, can be used for cleaning valve stems of carbon. Simply work the valves back and forth through the guide. The application of a little valve-grinding compound will hasten the work.—R. M. Sheldon, Dallas, Tex.

¶In grinding, a fast work speed will wear out the wheel faster than a slower work speed; the speed should be adjusted so as to secure the longest life of wheels consistent with efficient production.

Jig for Boring Dowel Holes True

On a job of making a number of odd-size cupboard doors by hand, it was found impossible to bore holes for dowels true in both directions until a piece of the stile was used as a guide, as shown in the illustration. The block was cut square and a strip of wood nailed to the side of the block to project over the door stile, after which the whole assembly was held firmly in a vise. The same method was also used in boring holes for mortises for locks in doors. In this case a strip of wood was nailed on either side of the block and the latter was then simply held in place with the left hand.—G. M. Beerbower, Hollywood, Fla.

Cutting Self-Hardening Steel

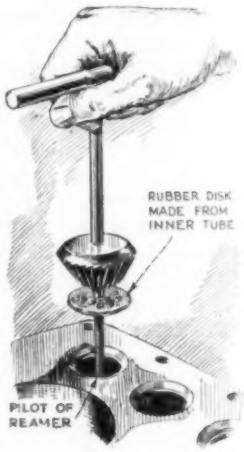
Self-hardening steel is too hard to be worked into special shapes, often required in the shop. Although brittle, it can be forged if treated with care. When red-hot it can be filed, although it is generally poor practice to file hot metals. When self-hardening steel is bought in bars, which must be cut up to the proper tool lengths, there is nearly always quite a bit of waste involved, unless a friction saw is used, and this is usually not part of the equipment in the average shop. Many workers break off pieces by holding the bar in a vise and using a large wrench, but the irregular fracture which results must then be ground down to shape, which is wasteful. The same objection holds true in cases where the corners and sides are nicked on an emery wheel and the fracture then effected. When hot, the bar can be cut with a cold chisel on an anvil with much less waste than by the two methods just mentioned, but the best method is to grind a groove on one side of the bar only, and to make light nicks in the adjoining two sides, leaving the fourth side untouched; then break off the piece. The advantage of this method is that the general shape of the tool edge is formed by such grinding, and it will then require very little more grinding to finish it.

Stretching Photos Cut Too Short

Practically all photographers and photo finishers have wasted time and material when their print trimmer has slipped a notch and the print is cut too short to fit the frame. To avoid the necessity of making a new print proceed as follows: Place the print in water and let it soak well. Then put it on a ferrotype plate and squeegee it with heavy pressure. From experience, I have found that a print will stretch from ⅜ to ¾ in. per foot by following this method, depending on whether it is single or double-weight paper. Since the average framed photograph is 5 by 7 in. or over, this added length will generally be sufficient.—Kenneth Keith, Chicago.

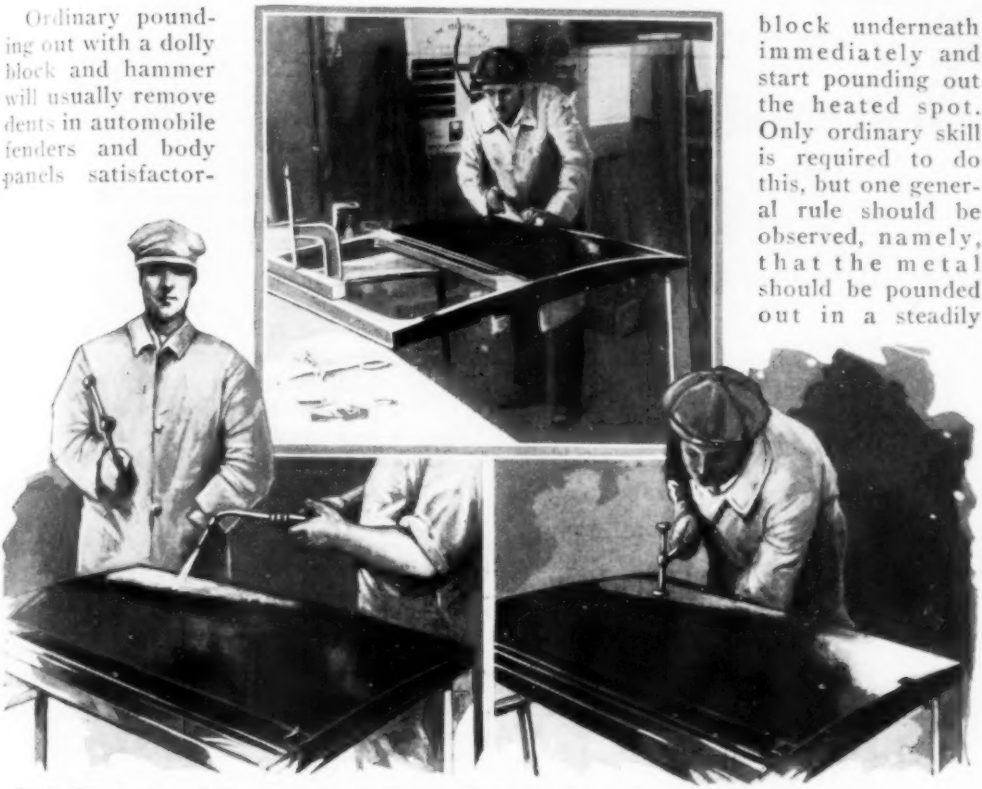
Rubber Disk Catches Valve Reamer Cuttings

When reaming auto valves, it is a good idea to provide a rubber disk, cut from an old inner tube, on the lower end of the reamer shank, to retain the cuttings and prevent them from getting into the combustion chamber, where they would cause excessive wear on the cylinder wall. The disk should be a trifle larger than the valve port and should be kept as tightly as possible against the underside so that no cuttings will get past it. When pulled out, all the cuttings will come with the disk.—F. J. Wilhelm, Cincinnati, Ohio.



HEAT TREATMENT REMOVES DEEP AUTO DENTS

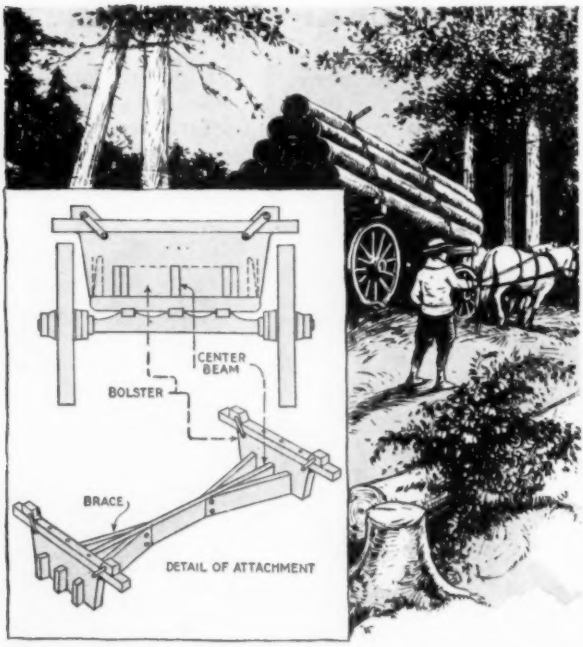
Ordinary pounding out with a dolly block and hammer will usually remove dents in automobile fenders and body panels satisfactorily, but when the dents are so deep that the metal actually has stretched, it is impossible to get a smooth surface without wrinkles and bulges. In such cases the metal can be shrunk by heat. Remove the paint or lacquer about the dented spot and shine it up with a coarse file and sandpaper. Apply the heat with a torch, covering a small spot, about the size of a silver dollar, at a time and bringing the metal to a cherry-red. Place the dolly block underneath immediately and start pounding out the heated spot. Only ordinary skill is required to do this, but one general rule should be observed, namely, that the metal should be pounded out in a steadily diminishing circle. Then heat another spot and continue in the same way. Under the blows of the hammer the metal can actually be seen to shrink until it becomes as taut and smooth as a new piece. All that remains to be done is to sand off the spot in order to remove any burnt paint, etc., before covering with enamel or lacquer, using a sander as shown in the upper photograph.—Kenneth Murray, Sturgis, Mich.



When Car Panels or Other Parts Are Badly Dented, the Metal Can Be Shrunk by Heat Treatment before Pounding Out to Prevent Wrinkling and Bulging

Wooden Guard Prevents Water from Splashing in Gas Engine

The water hopper or jacket on many types of small gas engines frequently allows the water to splash out, particularly when the engine is mounted on a cart where the vibration is more noticeable than it is in the case of a stationary engine. A satisfactory and practical method of keeping the water in the box in spite of vibration is as follows: A rectangular piece of ½ or ¾-in. wood is cut and laid on the surface of the water. The piece is first cut just a trifle smaller than the inside dimensions of the tank, but it must then be cut in several pieces in order to get it through the opening. The block does not interfere with pouring in fresh water and it rises as the box is filled.



Hardwood Bolsters Fitting over Standards Make Attachment for Hauling of Logs

Log-Hauling Attachment for the Farm Wagon

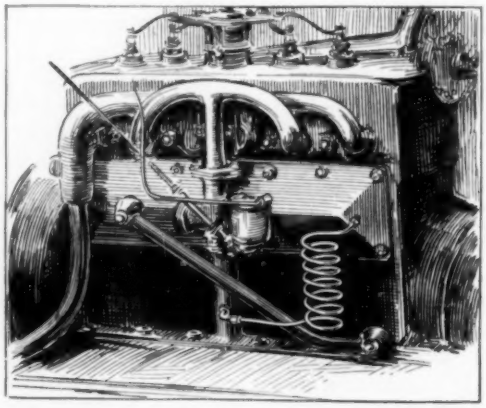
An ordinary farm wagon cannot be used successfully in hauling logs without the aid of an attachment of some kind. To convert their farm wagons into suitable log wagons, a number of Mississippi farmers have adopted the use of an attachment of the kind indicated in the drawing. Two bolsters are made of seasoned hardwood and mortised to fit over the standards, at the same time resting firmly on top of the regular bolsters. For additional strength and sturdiness, the bolsters are connected by means of a strong beam of timber securely bolted in the center of each, and braced as shown. With this arrangement it is possible to pile on a good load of logs without endangering the wagon. This device can readily be removed without unbolting any braces.

Vent Your Dies to Get Sharp Impressions

Many pressmen have spent hours and days in the endeavor to produce sharp and full impressions on figured pattern work. A simple method, which gives good results, is to vent all the large and deep recesses of figured dies with a small drill. This allows the air inside to escape when the blow is struck, and produces a perfect impression with only one-half the force that is necessary in unvented dies.—Kenneth Keith, Chicago.

Oil Cooler for Model-A Ford

It is an easy matter to make an effective oil cooler for your model-A Ford, from a length of copper tubing and two fittings, which will prevent the oil from thinning on long or fast drives, and thus assure the delivery of a quantity of cool oil to the valve-chamber reservoir at all times. The oil-line plug directly below the carburetor is removed and an L-fitting inserted. A ¼-in. hole is drilled and tapped in the valve-chamber cover, about 1 in. from the right edge, and an I-fitting installed. About 8 turns of ¼-in. copper tubing are wound in a 5 or 6-in. spiral. A large thermos bottle will be found handy to use as a form for bending the tubing. The ends of the tubing are then connected to the fittings. Although the coil is rigid, a support may be provided, if desired. The air forced backward by the fan strikes the coil and cools the oil.—W. Allen Taft, Jr., Salisbury, Connecticut.



Copper Coil Installed on Ford Motor Keeps Oil Cool on Long and Fast Drives

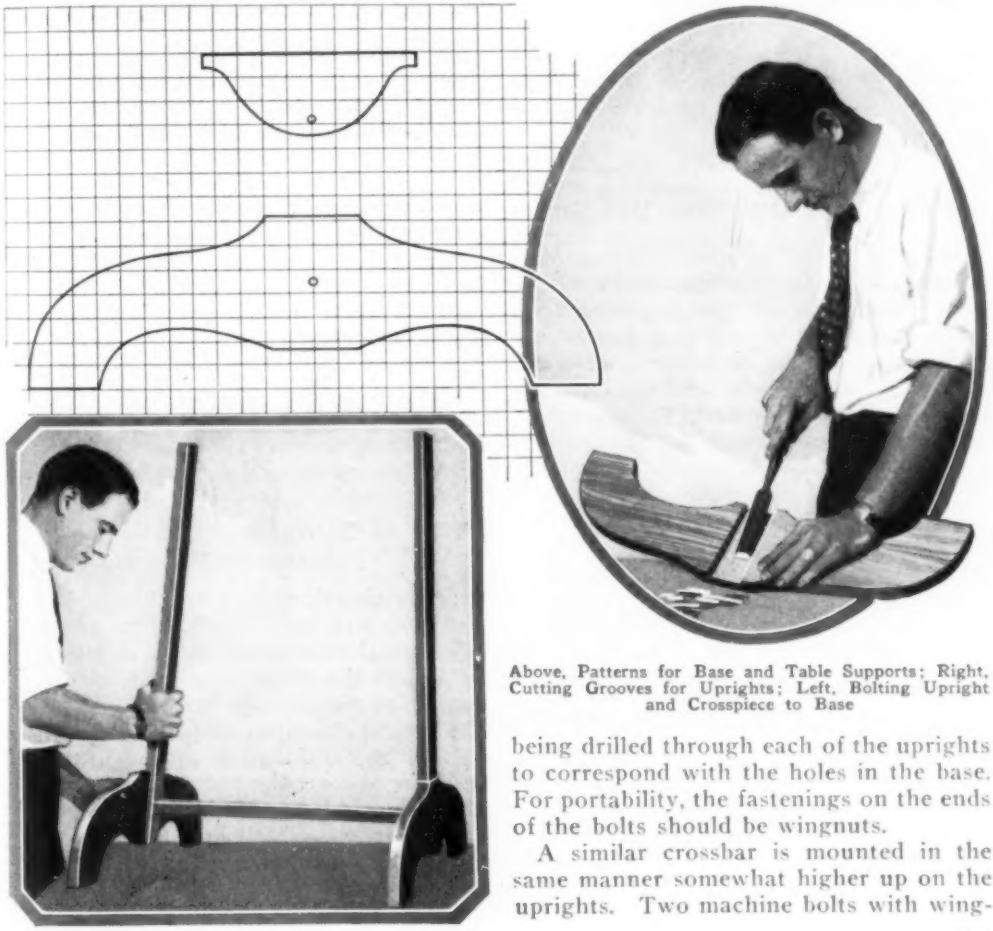
A Cheap and Practical Drawing Table

By RALPH T. MOORE

A DRAWING table is, of course, an absolute necessity to the draftsman or the artist, and is, besides, a very useful adjunct to the home worker. Here is one which possesses all the sturdiness of the studio table, yet it can be knocked down in an instant, packed into a 4 by 7½ by 31½-in. space, and thus easily transported to any place where it becomes necessary to do the work on the location.

The construction work on the table is started by cutting, from ⅞-in. white pine, four pieces of the size and shape shown in the drawing, in which each square represents 1 in., two pieces from each pattern. These are to be drilled with ¼-in. holes at the points indicated. The center portion of each of the two large pieces is then chiseled out, as shown in the photo at the right, the cut being 7/16 in. deep and 2 in. wide. The 31½ by 2 by ⅞-in. uprights for the table are half-lapped at one end to fit into these cuts, as indicated in the photo below the sketch.

This photo also shows the 21 by 2 by ⅞-in. crosspiece which is fitted between the uprights at the bottom. Each end of this piece is fitted with a screw bolt, one end of which is threaded like a wood screw, the other like a bolt. The bolt end is clipped between the jaws of a vise, and the screw end turned into the wood, as shown in the photo, page 1052. The crossbar is then fitted into place, a hole

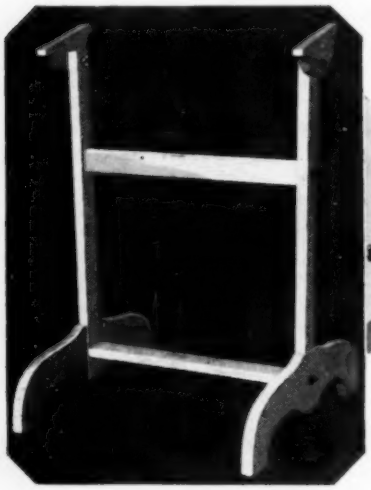


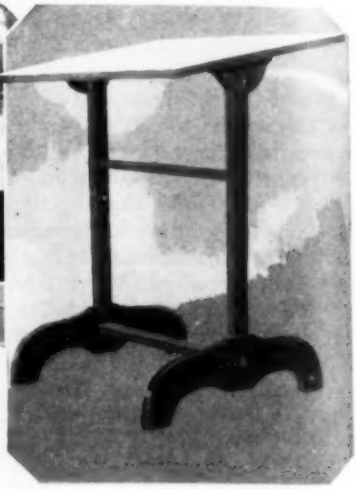
Above, Patterns for Base and Table Supports; Right, Cutting Grooves for Uprights; Left, Bolting Upright and Crosspiece to Base

being drilled through each of the uprights to correspond with the holes in the base. For portability, the fastenings on the ends of the bolts should be wingnuts.

A similar crossbar is mounted in the same manner somewhat higher up on the uprights. Two machine bolts with wing-

nuts are used to hold the semicircular pieces to the tops of the uprights, as shown in the assembly photos. Ordinary wood screws are inserted through the ends of these pieces and into the drawing board to complete the job.



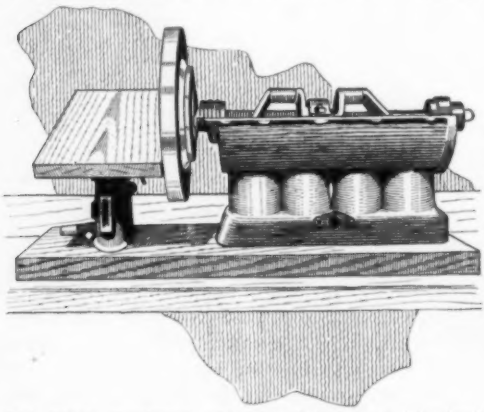


Center, Screwing Bolt into End of Crosspiece; Left, Table Assembled, Showing Fastening of Top Pieces; Right, Table with Drawing-Board Top in Place

I have used a board of this kind for many years, carrying it back and forth to different jobs, and I find it gives excellent service. You will find that it is perfectly steady, which most portable tables are not, and can be taken down in a few minutes.

Old Auto Parts Make Good Disk Sander

Mounted in an inverted position on a sturdy wooden base, a discarded model-T Ford block, to which the crankshaft and flywheel are still attached, makes an excellent disk sander for the small shop. Because of the weight and true-running qualities of the flywheel, the sander is really a precision machine. The block, after the valves and camshaft have been removed, is fastened to the base by means of the studs formerly used to hold the cylinder head. The main-bearing caps are drilled to permit oiling and the machine is driven by a belt attached to the fan pulley. A suitable table, which can be set at various angles, is provided to hold the work, and securely attached to the base as shown in the illustration.—A. C. Wilson, Columbia Cross Roads, Pa.



Old Block Equipped with Crankshaft and Flywheel Makes a Good Disk Sander

Wire on Refrigerator Cut-Out Switch Indicates Its Position

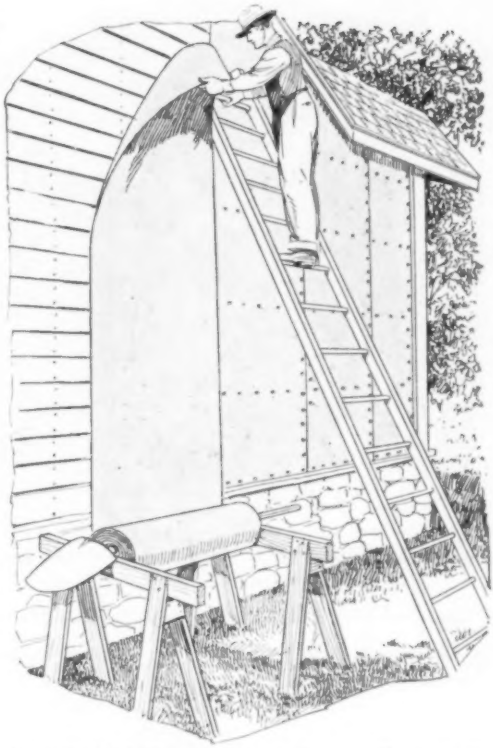
Some electric refrigerators on the market have a circuit breaker that switches off when the electricity in the house is cut off, when the motor overheats, etc. The handle of the circuit breaker is then in the "neutral" position and has to be moved to the "off" and then to the "on" position in order to start the motor again. When the motor is located on the top of the refrigerator, the circuit-breaker switch can readily be seen, but in many refrigerators the motor and switch are located under-

neath, and then the housewife has no means of knowing whether the switch is on or off until she finds the box defrosted and the ice cubes gone. To remedy this trouble, I fastened a length of stiff wire to the circuit-breaker handle and extended it through one of the ventilating fins in the front cover of the motor compartment. In this way the end of the wire, which extended about ⅛ in. beyond the fin, could readily be seen, and its position naturally shifts with the handle of the switch to which it is attached. "On" and "off" marks can be penciled on the outside to indicate the position of the wire. In this particular case the switch was located near the front cover, but if it is placed elsewhere, equally satisfactory arrangements can be made in a similar manner.—Jesse M. Myer, St. Louis, Mo.

Drill-Press Extension Chuck

In a shop where the only drill equipment is a vertical press, an extension chuck attachment has been found highly useful for some jobs that are too heavy to be lifted on the table or too big to go between the table and the spindle. The extension is made to take a chuck similar to the one on the press to go through the clearance hole in the table, and to be gripped in the drill-press chuck. With such an attachment, many jobs that would otherwise have to be sent out can easily be taken care of by blocking them up on the floor as shown. The clearance hole in the table can be bushed to serve as a guide if necessary.—Harry Moore, Hamilton, Can.

¶When replacing belts put them on the driver wheel first.



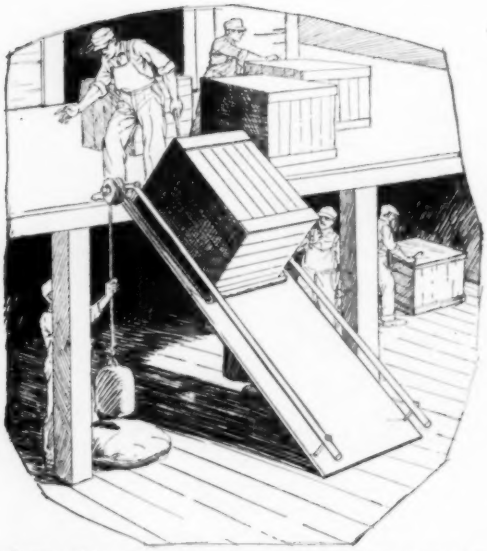
Long-Handled Shovel Makes It Easy to Handle Rolls of Building Paper

Holder for Building Paper

When tacking building paper to the side of a house, it is often rather difficult to handle the roll if it is left lying on the ground. To overcome this trouble, run a long-handled shovel through the roll and support the two ends on sawhorses. The blade of the shovel prevents the handle from sliding or turning on one horse, and two nails driven on either side of the handle where it rests on the latter, prevent that end from moving. It is then an easy matter to pull the paper to the position where it is to be tacked on the wall. When you come to a window, paper right over it and cut the opening later.

Removing Spindle-Bolt Bushings

To remove worn spindle-bolt bushings on automobiles, try the following method: A U.S.S. tap of the correct size is used to cut threads in the old bushings. Then screw a bolt of the right size into the threaded bushings and a hammer can be used to drive them out.



Steep Skid with Suitable Counterweights Used for Lowering Heavy Loads

Balanced Skid for the Loading Platform

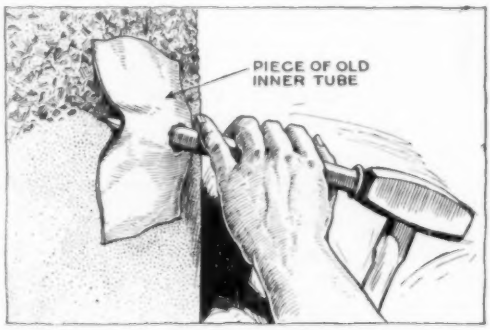
In places where a skid is required to lower heavy boxes or there is not sufficient space to use one having an easy grade, it is possible to employ one with a steep grade, if a counterweight is provided as shown in the drawing. The skid proper is made of ⅜-in. steel plate, and it may be necessary to mount it on 2-in. stock, depending on the weight of the loads it has to carry and on its length. At each corner of the skid a hole is drilled, and two guide rails, also drilled, are attached to the skid by short posts as shown, using spacing collars between the two. Before assembling, the rails are bent outward at right angles at the top to take a light grooved wheel held in place by means of a pin at the side. Next, a length of tube is cut off that fits nicely between the skid and the rails, and a wire rope of suitable length is passed through this and over the pulleys, the ends finally being fastened to the weights beneath. Care should be taken to see that the counterweights drop on a soft pad to prevent sudden shocks to the skid.—Harry Moore, Hamilton, Can.

Rebabbitting Steam-Engine Bearings

A mechanic rebabbitted the crankshaft bearings of his stationary steam engine without experiencing any subsequent trouble through false alinement. He raised the crankshaft and placed a piece of leather, about ⅛ in. thick, in the bottom half of each bearing to compensate for loss of metal through friction. He then let the shaft down and prepared the upper halves by removing the old metal, replacing them subsequently and pouring the babbitt. After they had been removed, peened and scraped so that they fitted properly, he raised the crankshaft again, and removing the pieces of leather, he prepared the lower halves for the babbitt and replaced the leather to avoid marring the bearing surfaces of the shaft against the stripped iron. He then reassembled all the parts, raised the shaft up against the rebabbitted upper halves, blocking it in position, and again removed the leather. The upper bearings were then removed to make the lower ones easy of access, and the latter were rebabbitted after puttying. These were then peened and scraped, and the whole reassembled.

Rubber Shield Protects Worker from Flying Chips

Flying chips, produced by a star drill or cold chisel on stone or cement, can be prevented from injuring the worker by using a rubber shield. Take a piece of rubber, removed from an old inner tube, and cut a small hole in the center so that it can be slipped over the tool. Keep it near the point, as indicated, and you will not be troubled by chips as they are all stopped by this shield.—Frank W. Bentley, Jr., Missouri Valley, Iowa.



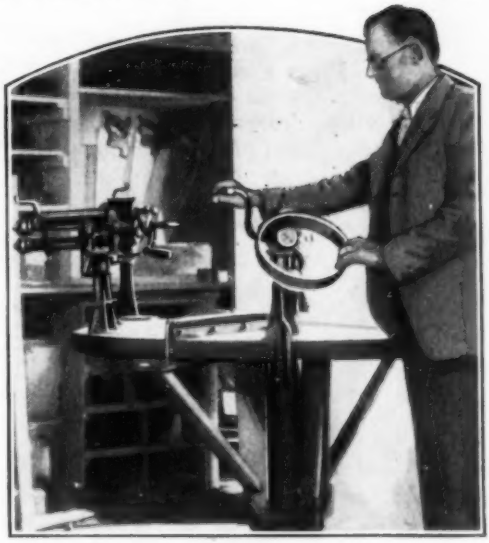
Rubber Shield Cut from Old Inner Tube Stops Flying Chips of Concrete

Increasing Capacity of Electrolytic Rectifier

A close study of an aluminum electrolytic rectifier while in operation will show that there is an accumulation of hydrogen bubbles on the aluminum element. If the cell is allowed to stand idle for five minutes, the bubbles will disappear. If an ammeter is connected in the output circuit and then the alternating current turned on, the meter will show a higher reading for the first few seconds and the current will then taper down to about one-fourth of the initial rate. This reduction is caused by hydrogen covering the plate, which increases the resistance of the electrolyte at the surface of the aluminum. This is the same thing that happens to certain primary cells and is called "polarization." By using a simple method of causing the hydrogen to leave the aluminum, the capacity can be greatly increased. This is done by slitting the aluminum plate from the bottom up to within ⅜ in. of the top, to form strips or ribbons about ¼ in. or less in width. The hydrogen does not seem to have any tendency to cling to the many edges now presented, but quickly rises to the surface as fast as generated. This slitting will increase a cell's output four times.—Clinton C. Hubbell, Norwalk, Conn.

Clothespin Holds Sack on Grain Spout

Instead of using hooks to hold sacks on a grain spout, try the method shown in the drawing. A narrow flange of molding is nailed around the edge of the spout and an ordinary clothespin hung in a convenient position. After the mouth of the sack is brought over the molding, the clothespin is slipped over the projecting edge of the sack, holding it in place. This method is also preferable to the use of hooks, as the latter cause considerable wear on the sacks.—G. E. Hendrickson, Argyle, Wis.



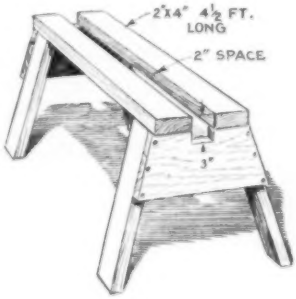
Revolving Table for Sheet-Metal Machines Saves Space in Small Shop

Revolving Table for Sheet-Metal Machines in Small Shop

A Missouri plumber and sheet-metal worker saves a great deal of space in his shop by using a revolving tool table, as shown in the photo. It is made from a discarded windmill head, braced and pivoted on a suitable base, which can readily be improvised. Several sheet-metal bending machines are mounted on the table and each can be turned to the most convenient position for the worker. The table is located in a corner of the shop, and is a real space-saving feature.

Carpenter's Trestle Aids in Ripsawing

For ripsawing, the ends of a divided trestle, as shown in the drawing, make a firm support. Such a trestle also will be found handy for many other jobs around the woodworker's shop. For example, when using long glue clamps, these can be laid in the opening, the gluing job resting flat on the trestles. — H. Lemaster, Maryville, Missouri.



Simple Device for Thawing Water Pipes Electrically

Water pipes, frozen in places inaccessible to applications of flame or hot water,

Quick Method of Thawing Out Frozen Water Pipes by Electricity

or in which these methods would be injurious to the surroundings, can be cleared quickly and safely by means of a device constructed as follows: Bind the bare wires at one end of a length of lampcord to the end of a stick which is long enough to reach the frozen pipe. Wrap a piece of cloth a few times around the end of the stick so that it completely covers the bare wires. At the further end of the cord fit an attachment plug with both the leads under one screw of the plug, leaving one terminal dead. Insert the plug into a near-by socket, dip the cloth-wrapped end of the stick into saturated salt water and apply to the pipe as indicated. If there is no action, the plug or wires connected to it must be reversed. With proper connection, the contact of the wet semi-conducting cloth with the pipe will be attended by hissing and clouds of steam from the heat generated at the surface of the pipe by the passage of the current between the cloth and pipe. The current consumption is not more than 6 or 7 amp. and will clear a pipe in a few seconds. Do not make a direct connection between the wire and the pipe, which may accidentally occur if the rag slips down or wears out.—Dexter W. Allis, Everett, Massachusetts.

Corncobs Make Good Building Insulation

Where corncobs are available, houses and barns can be insulated against heat and cold at very low cost. This insulation seems to be fully as effective as ground cork, often used for the purpose, but the cost of the cobs is negligible compared with that of the latter. Farmers who have plenty of cobs at hand and their own feed grinders, have no expense whatever except their labor. The cobs should be reasonably dry and should be ground in the grinder to about the fineness of ordinary chicken feed. For convenience in handling, the cobs should be run from the grinder into sacks. The ground cobs, which are light in weight like cork, are then poured between the hollow walls of the building. They are also spread out to a thickness of about 4 in. in the attic, over the ceiling of the rooms directly underneath. This is done, of course, before the attic is floored. A few pounds of moth balls, evenly distributed, will discourage insects and rodents, although, if desired, all openings can be blocked off with concrete. Even if the openings are open, rodents attempting to tunnel up the side walls would be smothered by the loose mass of ground cobs. Besides, there is very little possibility of cobs catching fire, as an experiment in an old shed showed that the ground cobs actually smothered fire when an attempt was made to ignite them.—R. F. Starzl, Le Mars, Iowa.

Helps for Home and Shop

YOU CAN MAKE IT—One hundred illustrated articles telling how to make toys, furniture and dozens of other things from old boxes and odd pieces of lumber. Price Ten Cents.

POPULAR WOODTURNING—Especially written for the amateur, this book should be in the kit of every home workshop owner.....Price Twenty-Five Cents.

MODERN HOME INTERIORS—Crammed full of suggestions for the home owner who likes to make his own built-in conveniences.....Price Ten Cents

Order any of the above from the Librarian, Popular Mechanics Magazine, 200 E. Ontario St., Chicago, inclosing the proper amount in stamps or coin.

BOYS!! a college education!

ENROLL IN THE

FISHER BODY CRAFTSMAN'S GUILD

984 awards valued at $50,000 offered for excellence in craftsmanship

How would *you* like a Scholarship to your favorite University or College, *with all expenses paid for four years?* This opportunity is open to you when you enroll in the Fisher Body Craftsman's Guild. And there are no fees or dues of any kind connected with membership.

Like the famous Craft Guilds of olden times, the Fisher Body Craftsman's Guild was founded to honor and advance the art of fine workmanship. But never in the history of the world have boys enjoyed such opportunities for reward and self-advancement as this modern Guild now offers you!

In addition to four University Scholarships of four years each, valued at $5,000 apiece, there are 980 other substantial awards, bringing the combined value to more than $50,000! Included are trips to the world's greatest automobile center, with recognition leading to careers in industry, as well as numerous awards in gold amounting to $16,000.

Awards go to boys building the finest model Napoleonic Coaches

To compete for the awards, each member of the Guild will be required to build a miniature model coach whose design is taken from two world-famous coaches used by Napoleon. Detailed drawings and instructions on how to build it at every step will be supplied by the Guild.

The best coaches will be selected by an honorary Board of Judges, consisting of distinguished University Educators and headed by Daniel C. Beard, National Boy Scout Commissioner. The awards will be equally divided among two groups, one group for boys of 12 to 15 years, inclusive, and the other for boys of 16 to 19 years, inclusive. In this way, every member will have an equal opportunity to share in the valuable awards.

ENROLL NOW, WITH NEAREST GENERAL MOTORS DEALER

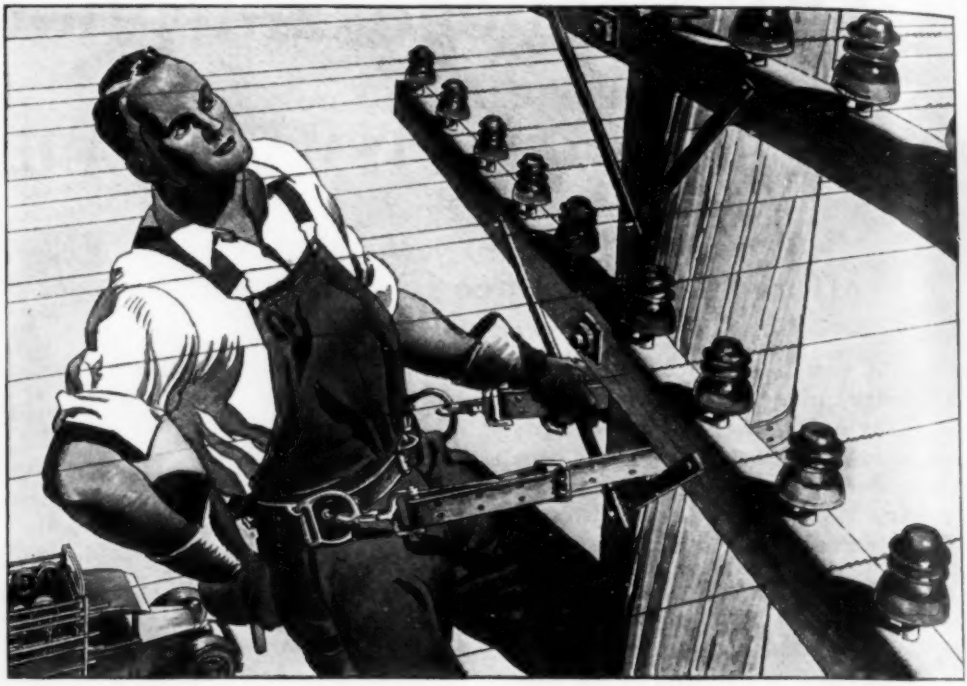
If you are between the ages of 12 to 19 years, inclusive, just go to any Dealer for Cadillac-La Salle, Buick, Oldsmobile-Viking, Oakland-Pontiac or Chevrolet cars, and ask him to enroll you in the Guild. There are no fees or dues. In a few days, you will receive your membership certificate, button, and complete drawings of the miniature model Napoleonic coach that you will build.

The door of opportunity is wide open for any boy with the energy and enterprise to enter and take his place in the Fisher Body Craftsman's Guild.

Hurry. See a General Motors Car Dealer today and enroll!

FISHER BODY CRAFTSMAN'S GUILD

Sponsored by FISHER BODY CORPORATION *Division of General Motors*



The continent that became a neighborhood

An Advertisement of the American Telephone and Telegraph Company

THROUGH slim wires etched against the sky . . . through cables laid in the earth under cities and fields . . . millions of Americans, miles or days' journeys apart, speak to each other as readily as though they stood face to face.

Over her telephone, a housewife in a Wisconsin town inquires about a dress pattern from a friend who lives nearby. Over his telephone, a business man in Philadelphia talks to another in Denver. Over her telephone, a mother in Kansas asks her son at college fifty miles away if he will come home for the week-end. Over his telephone, a cabinet member in Washington gives instructions to an assistant in Seattle. Regardless of distance and the complexity of modern living, they talk directly and immediately with any one, anywhere, at any time they choose.

The function of the Bell Telephone System is the vital one of making it possible to maintain social and business contacts in cities that contain many times more people than this nation once boasted . . . in a neighborhood which the Census reports to hold 127 million people. Year after year from its beginning, the Bell System has increased its facilities, its personnel and its usefulness. Looking ahead and planning for the future, it has forwarded the growth of this nation by meeting its communication needs fully and economically. Today it overcomes the hindrances of distance and time . . . and unifies a civilization geared to the habit of instantaneous communication.

Because it serves all who call on it, by enriching their lives and helping to make their enterprises more successful, the telephone plays an increasingly useful part in the every-day activities of the American people.

AMERICAN TELEPHONE & TELEGRAPH CO. BELL SYSTEM AND ASSOCIATED COMPANIES

How I MADE UP *for* JOHN'S *Shrunken* PAY CHECK

How a Little Home Business Brought Independence to This Man and Woman

"THEY'VE cut our piece rate again," John said bitterly as he gloomily ate his supper. "I've been working at top speed and then only making a bare living, but now—"

It had been hard enough before but now—with John's pay check even smaller—I feared it would be impossible to make ends meet.

Idly I fingered through the pages of a magazine and saw an advertisement telling how women at home were making $15.00 to $50.00 a week supplying Brown Bobby greaseless doughnuts.

"Why can't you do the same?" I asked myself. "Why can't you do what others have done. Investigate!" I did. In a few days I received details of the Brown Bobby plan. It seemed too good to be true because it showed how I, without neglecting my housework or little Jimmy could easily make money.

Well to make the story short, I went into the business without telling John. I passed out sample Brown Bobbys to my friends, gave out a few samples around restaurants, lined up a couple of grocery stores. In my first week, I sold 238 dozen Brown Bobbys at an average profit of 15c a dozen.

When John brought home his next pay check, he threw it down on the table and said gloomily, "I'm sorry, honey, but it's the best I can do."

"It's not the best you can do, darling, and I almost cried when I told him of the money I had made selling Brown Bobbys. It was the happiest moment of my life.

Inside of three weeks John quit his job at the factory to devote all his time to Brown Bobbys. Now we are dissatisfied at less than $150.00 a week.

Women interested in making $15.00 to $50.00 in their spare time are invited to write for details of the Brown Bobby plan to FOOD DISPLAY MACHINE CORP., Dept. 312, Chicago, Ill.

MEN, TOO!
Make Big Money

Men, here is a real, red hot money-making opportunity! It's a chance to jump into business for yourself and make more money every week than the average man makes in a month.

Surprising as it may sound, we actually put you in a business, with the first day's income often running from $18 to $55. $350 to $600 the first month is not unusual for ambitious men.

CUT IN ON THE BIG MONEY

All you need is the ambition to make real money. We supply you with complete equipment to make and sell that famous new food specialty—Brown Bobby—a greaseless doughnut baked by electricity!

Goodwin Sells $157.00 Worth in One Day

BROWN BOBBYS going big. Sold $157.00 worth today. Last Saturday, our sales amounted to $150.00, and the Saturday previous $112.00. This certainly indicates that our business is rapidly increasing, and unquestionably will grow to great proportions.—*William Goodwin*

Stephens Clears $20.00 Profit First Day

BROWN BOBBYS a sensation. Selling like wildfire. Keeping me busy night and day to supply demand. My first day's sales from one machine netted me $20.00 clear profit. In the short time I have been operating I have sold over five thousand dozen BROWN BOBBYS. Selling all four machines can produce.—*Stephens*

Start At Once ANYWHERE!

Men and women everywhere are starting in this business daily! YOU cannot afford to delay. Send the coupon at once! TODAY!

FOOD DISPLAY MACHINE CORP.,
Dept. 312, 500-510 N. Dearborn St., Chicago, Ill.

Without cost send me details of your Brown Bobby plan.

Name.....

Address.....

City.....State.....

When they cut the pay roll

—will you be hunting for another job?

It usually comes like a bolt from the blue—

You are called into the manager's office—he looks troubled, worried—reluctantly he explains that business isn't holding up, he has more men than he needs. *And what can he do?*

Suddenly it dawns on you that you're being politely told you're *through!*

No more security for you—no more steady money coming in—and in your pocket, perhaps, only enough to last out the month!

You're cut off—and you've got to start selling your ability in competition with thousands of other men in the same fix!

WHAT assurance is yours that when the "axe" falls, it will not hit you?

What assurance is yours that if you are suddenly thrown out of employment—through no fault of yours—you can always get back in, at an attractive salary?

Thousands of men—in every large city in America—are face to face with that problem now.

Upon some the "axe" has already fallen. They are trying as best they can to sell their services, yet they find themselves faced with the fact that the market is flooded with men who can offer just as much as they.

Men Who Are Never Fired —Steadily Promoted

For thousands of others, however, the "axe" has not the slightest terror. Regardless of how drastically their employers chop the pay roll, they know they will steadily advance—either with the companies they now are serving or with others which need precisely what they have to offer.

For how can it be otherwise?

Suppose, for example, you could point to a cut of freight costs from four per cent of gross sales to two per cent, on a sales volume running into the millions—as did W. H. Story, experienced, successful traffic manager for an Ohio corporation . . .

Or suppose you could point to some twenty-seven suggestions you had already made to your company, representing savings from $20 to $75 daily—as did J. R. Hollingsworth, in charge of a shift of men at one of the big factories in Akron . . .

Or suppose, as a trained salesman, you could increase the sales in your territory 50 per cent—as did I. A. Gould, Michigan district manager for the Smith Agricultural Chemical Company, Columbus, Ohio.

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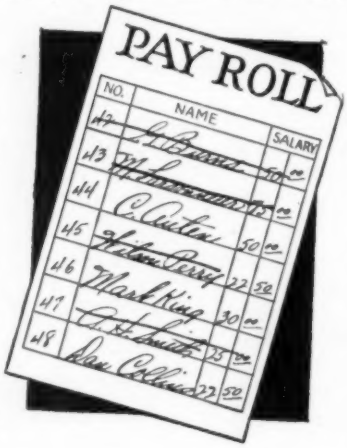

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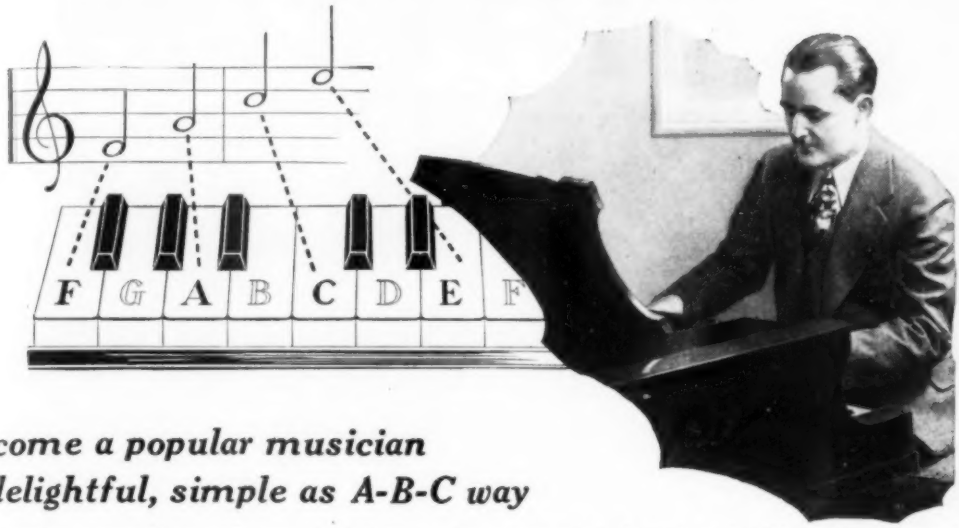

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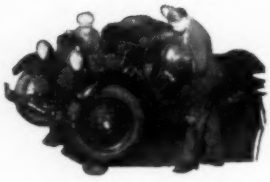

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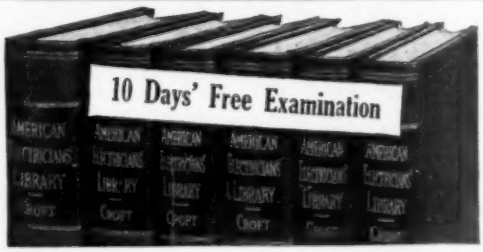

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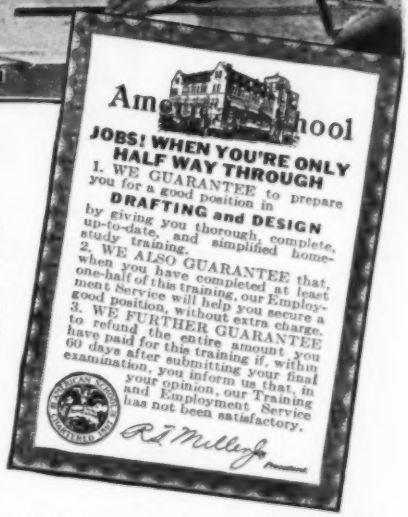

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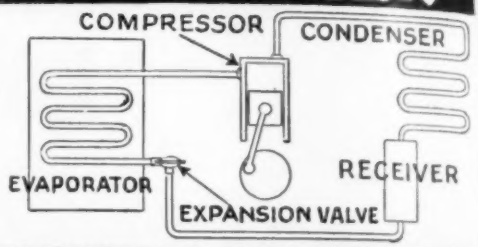

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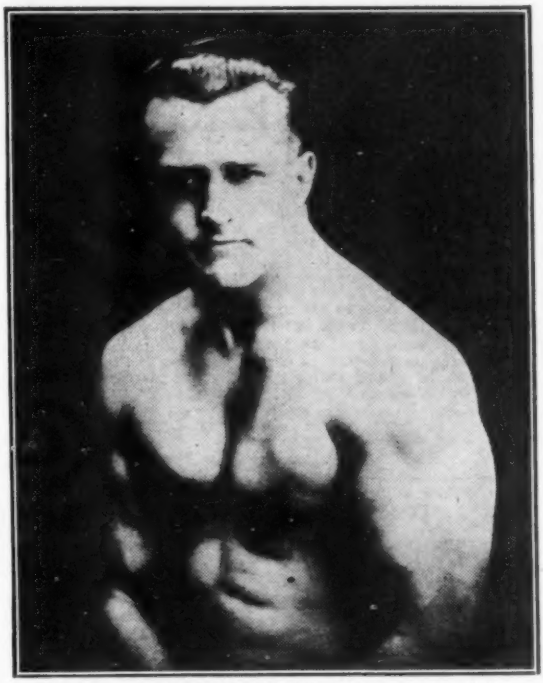

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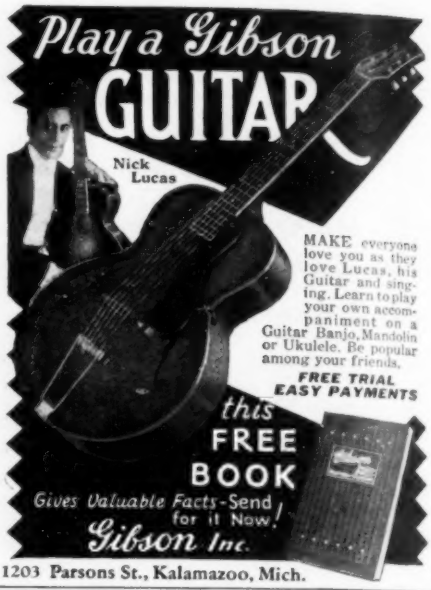

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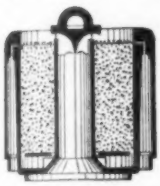

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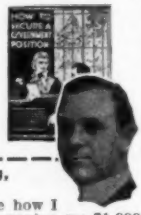

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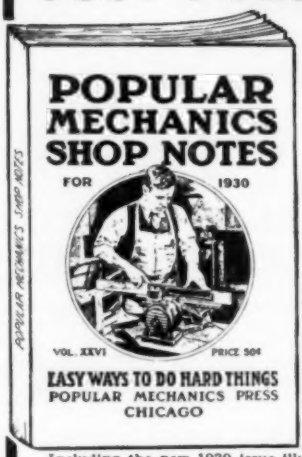

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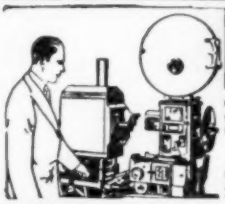

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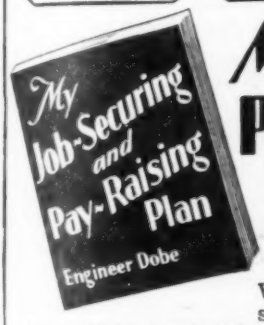

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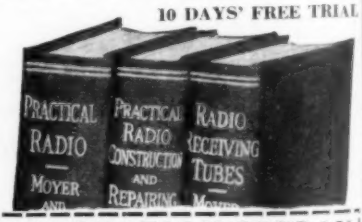

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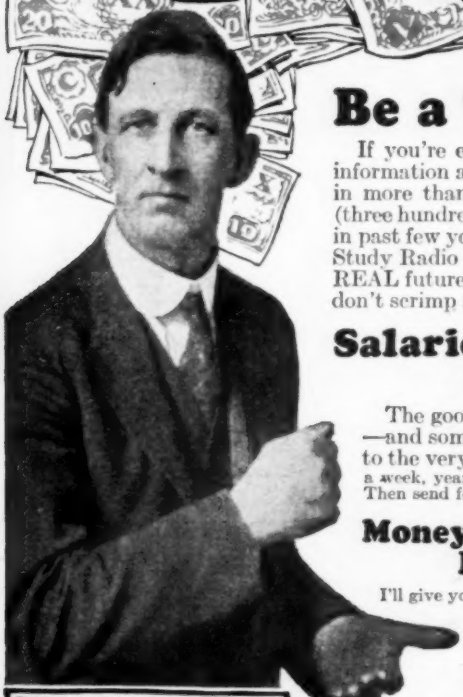

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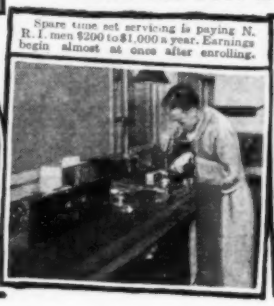

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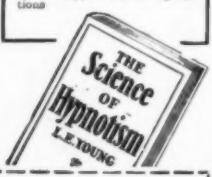

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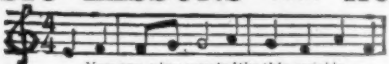

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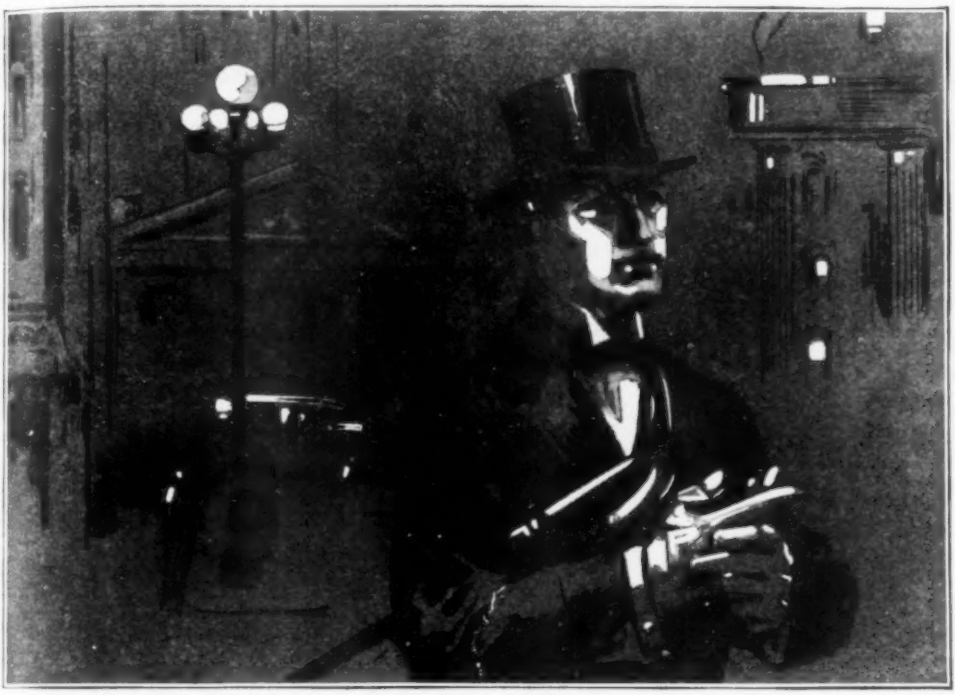

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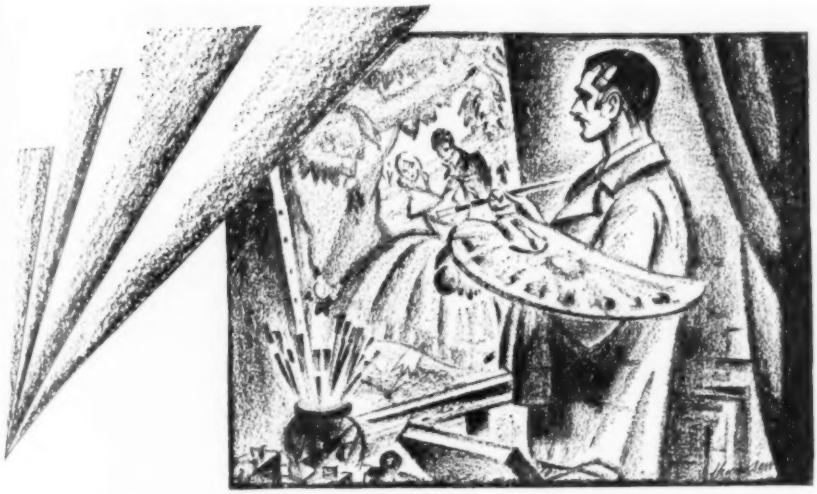

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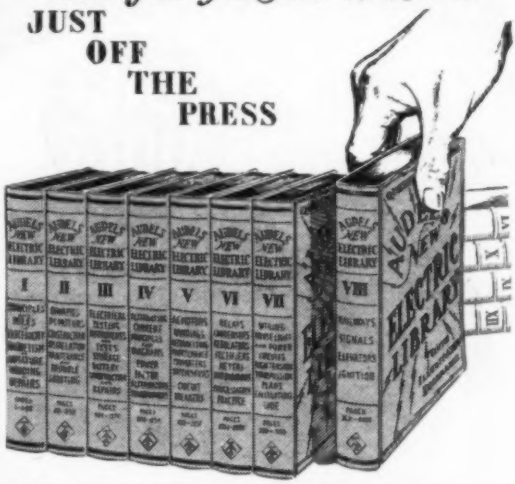

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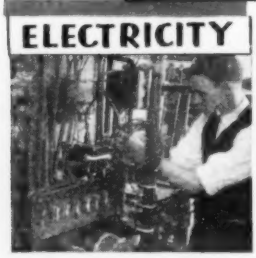

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KNOW The joy of a bigger income. Our extensive line of household necessities offers men and women equal opportunity to clear $75 weekly. Write B. & G. Rubber Co., Dept. 473, Pittsburgh, Pa.

THROW Away mussy liquids, powders, pastes. Brisko Polishing Cloth shines all metals like magic. Instant 25c seller. Tremendous profits. Sample free. Brisko, South Shaftsbury, Vt.

ADDING Pencil. Adds mechanically—almost human. Get sample immediately and make money easy and fast. Everybody interested. Add-O-Graph Co., Dept. 25, Saltillo, Miss.

BIGGEST Surprise offer ever made. Be sure to answer this ad. My line of soaps, coffee, tea, spices, toilet articles, household specialties, pays you bigger profits. M. G. Roth, President, 2708 Dodier, St. Louis, Mo.

AGENTS—80c Profit on $1.00 sales. Auto, furniture, metal, glass cleaner. Your name on labels. Free sample. Minute Kleen Laboratories, Dept. 7, Evansville, Indiana.

MAKE Big money with fast selling line of food products, prize motor and tractor oils—paints. Sure repeat orders. Write for free sample case. Loverin & Browne, 1602-G So. State, Chicago.

MEN And women. Make $15.00 daily selling underwear, hosiery, sweaters, raincoats, shirts, overcoats, sheeplined coats, leather vests, bathrobes. Northern Sales, 101 So. Wells, Chicago.

STRANGE New ironing cord! Prevents scorching. Saves electricity. Cannot kink or snarl. For telephones also. Up to $25 daily. Samples furnished. Neverknot, Dept. 12-A, 4503 Ravenswood, Chicago.

$2.98 RAINCOAT Line pays record-breaking profits. Flashy new numbers. Season on. Experience unnecessary. Outfit free. American, 3908AD Lincoln Ave., Chicago.

300% PROFIT Selling Mystery Gas Lighter. Retails 25c. Costs you $1.00 doz. Sample free. Square Deal Mfg., Desk PM-14, Bradford, Pa.

100% PROFIT In new mystery cigar lighter. No flint or friction. What makes it light? No wind can blow it out. Retails 50c. Sample and sales plan 25c. New Method Manufacturing Co., Box PM-12, Bradford, Pa.

AGENTS—Can openers, new improved hand, wall, table models. Safety Products Co., 315 American Bank, Kansas City, Mo.

JUST Invented—New washing machine. No motors or moving parts. Automatically cleans entire washing. Fully guaranteed. Retail price $9.50. Your profit 100%. Protected territory. Preston Mg. Co., Dept. CP-12, St. Louis, Mo.

JUST Invented—New oil burner, fits any stove or furnace. Burns cheap oil. Fully guaranteed; 100% profit. Free sample offer. Protected territory. International Heating Co., Dept. 509, St. Louis, Mo.

MAKE—Sell your own goods. Formula catalog free. Clover Laboratories, 178M, Park Ridge, Ill.

NEW Electric flashing sign just out—Changeable letters. Beautiful Neon color effect. Three sizes and styles. Unbreakable. Guaranteed. Every merchant buys on sight. 100% profit. Protected territory. Preston Mfg. Co., Dept. S-587, St. Louis, Mo.

NEW Automatic clothes washer. Washes quickly and thoroughly. No rubbing. No electricity. Retails $9.75. Guaranteed. Write Storm Royalty Co., 3601 Enright, St. Louis, Mo.

AUTOMATIC, Recoiling telephone pencils. New, attractive, practical. Three for one dollar. Jaffe', 254 West 31st St., New York.

AGENTS Buy direct guaranteed hosiery at lowest mill prices. Men's latest fancy hose doz. $1.40, $1.75. Ladies' French Heel silk hose doz. $3.50, $6.00. Catalog free. Superior Knitting Company, Dept. 3H, New-Haven, Conn.

MULZOL. New, wonderful external remedy. 100% profit for the first one hundred men to introduce it. Exclusive territory. Fenway Laboratories, Box 2402, Boston, Mass.

THE Magic Wire—Fastest selling novelty in existence. Sample 10c. American Specialty Company, Swampscott, Massachusetts.

BIG Money selling Dieodor foot and body powder. Repeat orders assured. Sample free. Box 25c. Dieodor Co., 112 Fremont St., Lowell, Mass.

OLIVER Cleared $700 in 30 days with our line of books and bibles. Outfit free! Exclusive territory! Nichols Co., Dept. B35, Naperville, Illinois.

WANT Distributing agent for Handlick, powdered handsoap; removes anything from the hands without injury to skin; everybody a customer; great opportunity for hustler to get in business; sample free. Solar Products Co., J2144 So. Troy, Chicago.

MAKE Your own products, employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1935W Broad, Richmond, Va.

$60-200 A WEEK. Genuine gold letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 438-B North Clark, Chicago.

BIG Proposition; no canvassing. Aos, Box 1081, Washington, D. C.

SELL Dustless ash can covers to householders who ask for demonstration. No house to house canvassing. Woodworth Specialties, Binghamton, N. Y.

NEW Dollar novelty, small, light weight, universal sale, big profit. Wonderful Christmas item. Schack Co., 15 West 44th St., New York.

NEW Deal—100% profit. Money returned on all goods unsold, end of thirty days. Money back to customer if article does not make good. Investment, $6.00. Balz Mfg. Co., Box 262, Bedford, Va.

EXCELLENT Trouser presser, $1.25. Agents 70c. L. J. Widness, 461 Sumner Ave., Brooklyn, N. Y.

SELLS Like hot cakes, big profits. New laundry preparation, perfumes clothes lastingly while washing them. Working sample 10c. Sunset Laboratories, Lynbrook, New York.

PORTRAIT Men—Big new catalog guaranteed portraits, frames, medallions, photo pillows, household specialties, toilet preparations, food products. Wonderful proposition. Credit. James Bailey Co., Station C—Chicago.

AGENTS—Marvelous invention—Nail File—fits, files and shapes each nail separately, single operation. Whirlwind seller. Huge earnings. Territories open. Sell drug, hardware, stationery and gift shop trade. Send 35c for sample dozen mounted on display card, $2.25. Datzit Nail File Company, Philadelphia.

ARE You old at forty? See our advertisement on page 136 of this issue. The Electro Thermal Company, 2136 Morris Ave., Steubenville, Ohio.

NEW, Profitable—Sell auto step mats. Quality rubber with owner's name molded white. Details free. Ebonite Products, Dept. U-40, 895 Main, Akron, Ohio.

JUST Out wonderful low priced can opener. Agents making money. Sample 25c. All-needs Mfg. Co., Box 26, Oak Park, Ill.

"DAIQUIRI" Havana cigars—Superior quality—95 delivered at your home $4.00. Cuban Products Co., Box 2238, Havana, Cuba.

AGENTS—Up to $12 daily demonstrating men's, women's, children's finest hosiery. Definite wear warranted or replaced. Amazingly low prices. 100 styles, colors. Auto and hosiery given producers. Write quick! Wilknit Hosiery Co., Dept. C-3712, Greenfield, Ohio.

THAXLY Formulas produce perfect products. All lines. Catalog free. B. Thaxly Co., Washington, D. C.

BIG Money easy, simply showing new Duly Wrench. 10 wrenches in one. Guaranteed fast seller. Sample furnished. Gellman Mfg. Co., Dept. 6-Z, Rock Island, Ill.

AGENTS. Everybody wants "Little Bill." 500,000 sold last year. 6 easy sales daily brings you from $13 to $127 weekly. Free gift to your customers makes it easy to obtain orders. Write quick. Redins, 6046 Superior, Cleveland, O.

I WILL send you $20 stock of food products, home necessities, on 30 days' credit. Send no money until you dispose of goods and collect your profits of $8.28. This starts you in big money business. Harley Co., Dept. W-2015, Cleveland, O.

MAKE Your own products, employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratries, 1935W Broad, Richmond, Va.

REPLATE Brassy worn-off automobile parts, reflectors, bath room fixtures, worn spoons, forks, etc., with pure silver. Looks like new. Use U-Kan-Plate Polish. Positively no mercury; $1.00 half pints. Postpaid. Satisfaction guaranteed. Agents wanted. Dept. A, U-Kan-Plate Co., Philadelphia.

MAKE $2 An hour, new household appliance needed in every home. 100% profit. Good Christmas item. Remarkable seller. Merry Maid Mfg. Co., Dept. 24, Cedar Rapids, Ia.

PLACE Showcards in windows. Beginners kit free. Big money. Easy work. No investment. Permanent income. Addiplier Company, 2516 Olive Avenue, Long Beach, California.

ONE Demonstration sells this new product for every home. Large profits. Particulars free. General Floor Corporation, 4010 W. Madison St., Chicago, Dept. P12.

NEW Signs, price tickets and changeable signs. Wonderful selection for Christmas and all year. Used in all businesses; $1.00 samples 25c. P. Franklin Co., 3322 3rd Ave., New York.

BIG Profit putting our gold sign letters on store windows, without experience. Samples. Consolidated, 69-T West VanBuren, Chicago.

MARVELOUS New liquified graphite increases mileage, doubles motor life. Cars, trucks, tractors, distributors wanted. Write Perell Co., 127 Main, LaCrosse, Wisc.

SUCCEED With your own products. Make them yourself. Formulas, processes, trade-secrets. Expert analytical service. Catalog, circulars free. B. Thaxly Co., Washington, D. C.

MANUFACTURER Wants distributor for new "Pocket Radio," only $3.85. "Sells itself with music." Pays 100% profit. Spencer Radio, Akron, Ohio.

FASTEST Xmas sellers, rhinestone initial belt buckles, etc., beat 'em all for quick easy orders. Big commission daily. Pocket outfit free. Chaton, 606 Blue Island, Chicago.

SELL Housewives something they want. They are bound to be interested. A signed guarantee to reduce gas bills 25%. No competition. 400% profit. Station C, Box 25E, San Diego, Calif.

1,000% PROFIT Manufacturing perfumes. Sample 10c. George Ross, 6521 Kenwood Ave., Chicago.

TIME Counts in applying for patents. See pages 140 and 141. Clarence A. O'Brien, Registered Patent Attorney, Washington, D. C.

SELL At once! 100 Blue Signs, Handy Container, $3.50. Koehler's, 717 North Fourth, St. Louis, Mo.

AGENTS—Engraved name plates, signs, number plates etc., easily sold with large profits. Brett Bros., Winthrop, Mass.

THE Magnetic safety light Admiral Byrd used on his South Pole expedition is a big money maker now. It's an everlasting flashlight. No batteries required. All automobile drivers want them. Send for demonstrator. National Electric Corporation, 220 High St., Newark, N. J.

BIG Money applying gold initials on automobiles. Easiest thing today. No experience needed. $1.45 profit every $1.50 job. Free samples. "Ralco," X-1043 Washington, Boston, Mass.

AGENTS—New shirt proposition. No capital or experience needed. Commissions in advance. Samples free. Madison Company, 566 Broadway, New York.

BIG Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.45. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 40, East Orange, N. J.

GET Our free sample case. Toilet articles, flavorings and specialties. Wonderfully profitable. LaDerma Co., Dept. A, St. Louis, Mo.

OUR Luminous crucifix and new luminous St. Therese statue shine brilliantly in the dark. Sell on first demonstration. Write for prices. W. G. Hannan Co., 2543 So. State, Chicago.

NO Dull times selling food! People must eat. Federal distributors make big money; up to $3,000 yearly or more. No capital or experience needed; unsold goods may be returned. We furnish free sample case, license and free samples for customers—sure repeat orders. Exclusive territory. Ask now. Federal Pure Food Co., A2307 Archer, Chicago.

AGENTS—Mosco corn and callous remover will build you a steady repeat business. Send today for pocket-size trial outfit. The Moss Company, 504 Searle Bldg., Rochester, N. Y.

OUR New card of 5c aspirin sells fast to stores. Over 100% profit. DeVore Mfg. Co., Desk C, Columbus, Ohio.

YOU Make 300% profit selling changeable signs to stores; six lines, three colors, cost 35c, sells $1.50. Robinson sold 18 signs in four hours. Particulars free. National Sign System, St. Louis, Mo.

"HOW To Secure Agents," a specially prepared booklet, tells of one of the most inexpensive methods in which to secure good live producing agents. It is free; write for your copy today! M. L. Rund, Mgr. Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago, Ill.

AGENTS Everywhere making money with our line of kitchen specialties, demanded in all homes. Big earnings possible. Write today for details. P. Seed Filter Co., 353 Broadway, New York.

BESTEVER Powdered Hand Cleaner. Removes Grease—Paint—ink instantly. Sells fast. Sample Free. Bestever Co., 400 Irving Park Station, Chicago.

NEW Line Counter Displays, Aspirin, Flints, Chewing Laxative, Breath Gum, Notartar, Siliktone, etc. Steady Repeats. Over 100% Profit. Superba Co., W5, Baltimore, Md.

CHICAGO Expert valued $3 stone at $900. The diamond's only guaranteed rival. Greatest spare time, side-line article ever known! Amazing profits. $5 pocket sample case free. Write quick. Mexican Gem Company, Dept. PM, Monterey, Calif.

MAKE Your own products, employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1935W Broad, Richmond, Va.

SELL Men's neckwear—wonderful proposition. Astor-M, 39 East 28th, New York.

FREE "Booklet of money making opportunities," new ideas, original plans, money making secrets and other valuable information. None require peddling or outfits. Elite Co., 84 Elizabeth St., New York.

SELL Stores 5c carded breathlets, etc. Lorrac Products, Albany, N. Y.

POLMET Polishing Cloth removes tarnish from metals without the use of liquid, paste or powder. Our agents say it sells like "hot cakes." Retails 25c; sample free. Gale & Co., Inc., 15 Edinboro St., Boston, Mass.

AMAZING Profits showing new table cloth. Looks like linen. Wash like oilcloth. No laundering. You just take orders. We deliver. Pay daily. Sample free. Bestever, 231 Irving Park Station, Chicago.

SELL 3A Garage door holders, simple, automatic, quickly installed. Interests garage owners, builders, everybody. Exclusive territory proposition. Knowlson-Stevenson Co., Ann Arbor, Mich.

MAN In each town to plate auto parts, reflectors, bathroom fixtures, refinish beds, mirrors, chandeliers; by new method. No capital or experience required. Simple plan of manufacturing at home starts you in big money-making business. Outfit furnished. Free particulars and proofs. Gun Metal Co., Ave. H, Decatur, Ill.

CALIFORNIA Perfumed beads selling like hot cakes. Agents coining money. Big profits. Catalog free. Mission Factory P, 2328 W. Pico, Los Angeles, Calif.

DOES 300% Profit interest you? World's best polishing cloth. Everybody buys. Sample free. Magicloth, 3317 Summit, Kansas City, Mo.

A BUSINESS Of your own—Making sparkling glass name and number plates, checkerboard signs. Big book and sample free. E. Palmer, 512, Wooster, Ohio.

WANTED: District manager to appoint agents. Unlimited opportunity. No canvassing. Mother Hubbard Products, 554U Congress, Chicago.

THIS Advertisement may make you thousands of dollars, if you write immediately for my "Eye-Opening" literature describing guaranteed formulas; valuable trade processes, money-making information how to easily make the world's best-selling specialties. All lines. Investment small. Profits immense! Start in your home, room or office. Make the good money you're entitled to. Dr. Liscombe Miller, Chemist, Tampa, Fla.

GENUINE Gold Leaf Letters anyone can put on store windows. Guaranteed to never tarnish. Large profits. Enormous demand. Free samples. Write today. Metallic Letter Co., 438-D North Clark, Chicago.

PHOTO Medallion men and women, the largest line of photo novelties in the world. Lowest prices, quickest service. Send for catalog showing over 200 money makers. Gibson Photo Jewelry Co., Inc., 833-837 Gravesend Ave., Brooklyn, N. Y.

GREATEST Opportunity; newest proposition. Build continually paying business in your own name. Household, industrial, brushes, brooms, mops, dusters, fully guaranteed. New catalog, all net prices, no discount to bother with. Make as high as 300 per cent and over. Write today. Wire Grip Sanitary Brush Corp., 41 East 11th St., New York.

AGENTS — Clever Invention! Inkspoon makes every pen a fountain pen. Fast office seller; big profit, demand increasing everywhere. Exclusive territory offered. Sample free. H. Marul Company, Tribune Bldg., New York, N. Y.

WE Start you without a dollar. Soaps, extracts, perfumes, toilet goods. Experience unnecessary. Carnation Co., 641, St. Louis, Mo.

AGENTS—Make a dollar an hour. Sell Mendets, a patented patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Co., Dept. 404, Amsterdam, N. Y.

15,000 PROFIT Making formulas. Following and many others: Accidents and emergencies, agriculture, alloys and amalgams, artist's materials, beverages, cements, glues, pastes, mucilages, bleaching, renovating, coloring metals, dyeing, glass, heat treatment of metals, household formulas, ice cream, confectionery, chewing gum, lapidary work, exterminating vermin, lubricants, paints, varnishes, photography, condiments, canning formulas, rubber, soap, candles, soldering, toilet preparations, perfumes, waterproofing, fireproofing, writing materials. Just write for "Scientific American Encyclopedia of Formulas." When postman hands you book pay $5.50 and postal charges. Popular Mechanics Press, Room 801, 200 E. Ontario St., Chicago, Ill.

HIGH-GRADE SALESMEN WANTED

NEW Endless chain selling plan guarantees you amazing profits and many repeat sales with America's greatest printing line. 40-55% profit on every order. 104-page catalog shows 1001 printing necessities for every business, including personal stationery, pictorial parcel post and shipping stickers, collection sticker system, advertising tags, druggist labels, etc. Thousands of free cuts. Lowest prices. Highest quality work. Main or sideline. Experience unnecessary. This is biggest profit-maker of the year. Write quick for new free 1931 outfit. Kaeser-Blair, Inc., Dept. 241, Cincinnati, Ohio.

A "NATURAL" for direct selling. For best baking results flour must be aerated by several siftings. A tedious task with the old-time sifter. Ask any woman. The Arkvale Multi-Sifter, a beautiful patented device, sifts flour the equivalent of six times at one simple, speedy operation. A proven "natural" for which there is an existing need and demand. If you want up to $100 weekly easier than you have ever earned it before, write today for complete information. Arkvale Household Specialties, Dept. A, Dodge City, Kan.

NEW And aplenty different—Fast selling 5c-10c merchandise on attractive counter cards. 100% commission for you and dealers. Advertised by radio. No capital required. Catalog free. World's Products (Estab. 1921), 109 Central, Spencer, Ind.

SELL Business printing. Hundreds of standardized items with illustrations, complete selling outfit for real workers, full repeat. A national service. All Trade Printing Service, 1112 N. Second St., Rockford, Ill.

WONDERFUL Invention. Seals fifty envelopes minute. Sells on sight at $2.25. Attractive trial offer. Square deal. Bank references. Kendall Sealer Co., Dept. C-25, East Jaffrey, N. H.

WANTED—Salesmen-Dealers. Selling experience unnecessary, but only reliable people need apply. We supply everything—products, sales outfits, sales and service methods that get the most business everwhere. Superior Rawleigh quality, old established demand, lowest prices, guarantee of satisfaction or no sale, makes quick sales. 200 home and farm necessities, all guaranteed best values. If you are willing to work steady every day for good pay, write for information how to start your own business with our capital. W. T. Rawleigh Co., Dept. L-RPPM. Freeport, Ill.

$18 TO $25 Daily; biggest selling line of men's suits, $11.95, $14.50, $16.95, $19.95. Amazing values. Pure virgin wool overcoats, $18.95. Also raincoats, slickers, topcoats and boys' suits. Biggest commission paid in advance. Liberal bonus. Free outfit. "Jim" Foster, Inc., Dept. 212, 2250 S. Spaulding Ave., Chicago, Ill.

SELL Nothing, earn up to $170 weekly empty handed. No sample case to tote. Oldest and largest punchboard firm, established 20 years, rated $500,000, announces amazing new plan. Salesmen cleaning up! No one invests a penny. We even pay express charges. Unsaleable merchandise returnable. Big season now here. Full commission repeat business. Grab this quick! K. & S. Sales Co., 4381-A Ravenswood, Chicago.

BRAND New union label printing line. Largest assortment cuts and specialty items in country at half price. 72 hour delivery. Big commissions advanced. Sensational bonus offer. Experience unnecessary. Outfit free. Northwestern, 625M Jackson, Chicago.

FIFTY Million homes want unbreakable drinking tumblers before Christmas. Two quarters bring you yours. Brown Co., 503 Morgan Bldg., Detroit.

BUSINESS Stationery—Largest line—Highest quality—Quickest delivery, biggest commissions, liberal bonuses. Free copyrighted cuts every business. Experience unnecessary. Instructions and outfit free. Willens Co., Dept. 335, 2130 Gladys Ave., Chicago.

BIG Money daily selling shirts, ties, underwear, sox, raincoats, lumberjacks, sweaters, leather coats, mackinaws, coveralls, pants, children's playsuits. Outfit free. Experience unnecessary. Nimrod Co., Dept. 65, 4922-28 Lincoln Ave., Chicago.

SALESMEN—Wonderful sideline. 40% commission paid daily. Sells all merchants. Pocket outfit free. David Lionel Press, 312 So. Hamilton, Dept. 181, Chicago.

SALESMEN Wanted—Exclusive territories open for line of electric tools for contractors, garages, industrials. Manufactured by nationally known concern. Straight commission. Men are making $400 per month and more. Give past experience and references. Room R, % Popular Mechanics Magazine, Chicago, Ill.

NEW, Startling, amazing! Ten to twenty-five dollars a day easily earned. Home protection $250 to $1,000 at death; ages ten to eighty. Not insurance, but a society furnishing protection at cost. Write American Benefit Corp., Managers, Myers Bldg., Springfield, Ill.

ATTENTION, Salesmen. Big profits assured in selling the old reliable Richmond Fire Extinguisher. The best and easiest selling fire fighter made. Always ready for use. Priced right. Free refills. Every one a prospect. Richmond Chemical Company, Silver Springs, Md.

EXCEPTIONAL Opportunity. $75 weekly. Write Farrand Chemical Co., Tyrone, Pa.

AMAZING, New, patented, fountain auto brush. Great demand, agents, distributors opportunity. Practical, priced right. Huge profits, sample $2.00 returnable. Modern Auto Washer Co., Gillespie, Illinois.

BIG Opportunity for salesmen with car. New, low priced, automobile hot-ignition gas-saver. Cumberland Manufacturing Co., Cumberland, Md.

CALIFORNIA Grape juice bricks! 100% profit for salesmen! For distributors! One brick makes one gallon; all flavors; Port, Sherry, Burgundy, etc., juice. Every home, hospital, drug and grocery store prospects. Write, Vino Sano Co., San Francisco, Calif., Dept. S-126, 235 9th Street.

POOL Shooters, new fascinating vending machine. Merchants everywhere buy! Splendid sideline. Big profit maker! Free pocket outfit! Specialty Mfg. Co., W-617 W. Division, Chicago.

VIRGIN Field! Super-quiet radio-motor generators. Play A.C. radios on farm lighting systems any voltage. Write for Bulletin 101-C. Rapco, 1447 East Anaheim, Wilmington, California.

MAGAZINE Salesmen—Our contracts ranging from $3.95 to $7.80 are sold with exceptionally attractive premiums, materially helping salesmen earn $60.00 to $100.00 weekly. Write for particulars. Geographical Publishing Co., 621 Plymouth Court, Chicago.

PUNCHBOARD Salesmen. New plan sells every merchant. Better terms, bigger commissions. Sure repeat orders with full commission. Experience unnecessary; outfit free! A. J. Novelty Co., 161 W. Washington, Chicago.

MAKE 33⅓% on fastest selling sales plan on market—90% repeats—sells everywhere all the time—Plan indorsed by biggest merchandisers in country—Adaptable for every class of business—Every merchant prospect—Sells on sight. Salesmen making up to $150.00 weekly. Want money quick—Get action, write today. Washington Sales, 157 W. Washington, Chicago.

AUTO Tabs sell freely to auto dealers, garages, etc. Dealers' name attractively imprinted. Salesmen now selling up to 25,000 tabs per week. Good commissions paid promptly. Thermo Co., Norfolk, Virginia.

SPECIAL Advertising offer: Sell $5 value quality toiletries for $1; astonishing repeats; make $15-$50 daily. Paris Laboratories, 2624 Olive, St. Louis.

SELL Merchants big $12 value for $5.75 and pocket $2.00 cash. More on repeats. Free kit. Sales Stimulators, Dept. 5H, 339 W. Madison, Chicago.

MEN—Women! Sell sensational $1.50 golf game for home playing. Big profits for Christmas. Sample offer. Noveltoy Corporation, 215 N. Racine, Dept. 31, Chicago.

SALESMEN To place dealers for large manufacturing company on Television products. Sales Manager, 308 Michigan Square Bldg., Chicago, Ill.

ARE You old at Forty? See our advertisement on page 136 of this issue. The Electro Thermal Company, 2136 Morris Ave., Steubenville, Ohio.

SALESMEN Making big money selling improved shirts with unshrinkable non-curling collar. Four shirts, $5.00. Liberal commission. Exclusive "Made-To-Measure" line. Free necktie with order. Menzin Shirt Company, Bridgeport, Conn.

BRAND New idea. 1930 Christmas Card line. Amazing seller. Experience unnecessary. Full-part time. Samples free. Windermere, (Established 1900) 6702 Dorchester, Chicago.

ADVERTISING Salesmen can make $200. a week selling our established line of syndicated house organs. Big repeat commissions. Satisfied clients in 39 states. Write for particulars. The Eastman Folks, South Bend, Ind.

PUNCHBOARD—Hurrah. New protection plan opens "closed" territory, creating tremendous demand. Dealers jubilant. Business booming. Commissions enormous. Outfit free. Puritan Co., 1407 Jackson Blvd., Chicago.

LIVEWIRE Salesmen—Sell cask 1,020 pieces white dishes, $40; commission, $8; cask decorated dishes. 1,020 pieces, $60; commission, $10. Baker Pottery, Salisbury, N. C.

SELL Stores our vending machines and 5c carded specialties. Over 15 quick-selling products. Robbin Products, 21 Dodworth Street, Brooklyn, N. Y.

DO You want a snap? Sell our effective premium business building plans to merchants everywhere. Big front money and 100% repeats. Write today and you'll be with us to stay. D. & H. Premium Co., Dept. D., 118 So. Wells, Chicago.

SALESMEN—Easy selling Die-U-Rat thru jobbers. 20% commission. Kills nothing but rats and mice. Rick Drug Co., Galion, Ohio.

SALESMEN: Our men earning $15-$40 daily selling to stores. Sayers Systems, Est. 1895, 2813 Sheffield, Chicago.

SELL Goodyear raincoats, $2.95 up. Goodyear Rainwear, 682 Sixth Avenue, New York.

BIG Profit putting our gold sign letters on store windows, without experience. Samples. Consolidated, 69-V West Van Buren, Chicago.

PUNCHBOARD Salesman—Most gigantic line ever featured. Vending machines, all kinds. Make high as $28.00 on single order. Repeat commissions. Beautiful colored catalog free. Lion Mfg., Dept. 8, 308 W. Erie, Chicago.

WANTED District managers. Oldest organization of its kind in accident and health insurance. Write today for information. Dept. 18. Inter-State Business Men's Accident Ass'n, Des Moines, Iowa.

BIG Pay every day. Bonus every week. Adelite sells everywhere. New spectacular electric window display. Ever-changing colors, original posters, patented changeable letters defy imitation or competition. Special models for merchants, banks, etc. Instant seller. Big repeats, full commission. Write for thirty day demonstration offer. Display Products Co., 409A East 31st, Kansas City, Mo.

$60-$200 A WEEK. Genuine gold letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 438-A North Clark, Chicago.

PUNCHBOARD Salesmen make big commissions, selling punchboards and vending machines. Reliable concern, established 20 years. Largest most complete catalog in colors, free. Best season now. Write today! Lincoln Sales, 116 S. Wells, Chicago, Dept. D.

SALESMEN—Become independent. Own your business; experience unnecessary, selling our $10,000 accidental death; $50 accident; $25 sick weekly benefits—$10.00 yearly. Other amounts proportionate. Guaranteed steady income from renewals. $250,000 deposited insurance department. Universal Policy, Dept. A, 716 Lefcourt Bldg., Newark, N. J.

SALESMEN Sell tires and auto accessories to garages, tire stores, filling stations, etc. Established line repeats everywhere. Liberal commission. Write for particulars. Economy Rubber Prod. Co., 606 Burkhardt, Dayton, Ohio.

SIDELINE SALESMEN WANTED

40-55% PROFITS Business stationery, 2000 styles. Lowest prices. New "endless chain" plan builds permanent business. Ideal side line. Experience unnecessary. Kaeser-Blair, Dept. 246, Cincinnati, Ohio.

HELP WANTED

ARE You tired of hard work, long hours and small pay? Get out of the rut! I'll show you how to be your own boss and make $15 profit a day. Simple, pleasant work. No capital required. Particulars free. Albert Mills, 5374 Monmouth, Cincinnati, O.

STUDENTS. College students or high school seniors who wish to make extra money. No canvassing. Saylo Supply Corporation, 220 Fourth Ave., New York City.

SHOE Shiners: Make more money shining shoes scientifically the right way. The Scientific Shoe Shine. Particulars free. Scientific American Cleaner, 432 Tenth, New Kensington, Pa.

EDUCATIONAL AND INSTRUCTION

ABUNDANT Money and fine position in community for you. Women or men. Study and practice foot correction. Help foot troubles by mechanical and orthopedic means. Few weeks study puts you in position to earn. No cutting. Practical, pleasant, profitable. Send for latest offer and free tuition plan. Lincoln Correspondence Institute, Inc., 1500 A Walnut St., Philadelphia.

"CARTOONING & Advertising art" Six separate books, 100 lessons, 1,000 illustrations, 66,000 words, patented "lift-out" cover, complete $5.00. Nothing like it in history of art publishing. Free specimen pages. No salesman sent. Fox, 417 Fifth Ave., New York City.

FIREMEN, Brakemen, Baggagemen; colored train or sleeping car porters, $150-$250 monthly. Experience not necessary. 810 Railway Instruction Bureau, East St. Louis, Ill.

ACETYLENE Pipeline welders earn $77 weekly. Thousands men needed this year and next. Free information. National Welding School, 710 Fairfax Airport, Kansas City, Kan.

MEN—Women, 18 up. Want a government job? $105.00 to $280.00 month. Steady work. Short hours. Paid summer vacation. Common education usually sufficient. Experience usually unnecessary. We coach you without leaving home. 32 page book with particulars and sample coaching free. Write immediately—Today. Franklin Institute, Dept. S3, Rochester, N. Y.

GREGG Shorthand—Complete, simple instruction, guaranteed, 25c week. Nation School, 53 Sanford Place, Newark, N. J.

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Instructor checking over record of pilot students at Parks Air College and giving helpful information as every Parks instructor is able to give these well-trained students.

TOP GRADE AIR PILOTS EARN $550 A MONTH

Night Mail Flyers, However, Exceed Average by $300 Monthly.

By Associated Press.

WASHINGTON, August 19.—Average monthly wages now being earned by airplane pilots of the highest capability class range around $550 per month.

The aeronautic branch of the Commerce Department ascertained the flight pay as a result of a survey of payrolls of air mail and passenger carrying enterprises for the first six months of 1930 and the last half of 1929. The pilots in this service are holders of the highest class of license obtained only after much experience and training.

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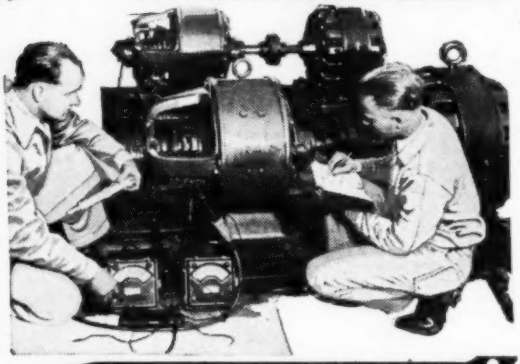

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LOS ANGELES is the heart of the country's most rapid electrical development—as well as the world's most ideal city in which to live and prepare for success in electricity.

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Age.....City.....State.....

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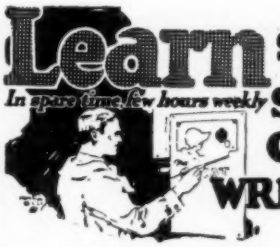

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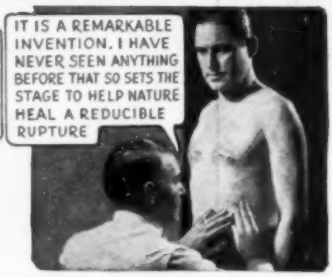
Address.....

City.....*State*.....

A TALKING PICTURE FOR RUPTURED PEOPLE!

Scientist Tells How New 4oz. Invention Often Ends Truss Handicaps Quickly

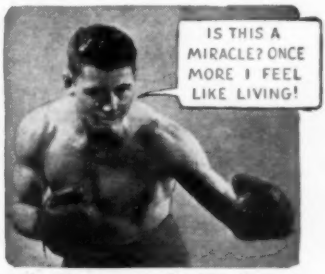
In December, 1925, after more than 100 experiments in his laboratory, an Ohio Scientist finally developed and perfected the idea that has greatly helped rupture treatment.



Physicians praised this new discovery. Tests on cases of long standing showed good results in many instances. Dr. J. B. Walkinshaw of West Virginia expresses himself as above when he saw the appliance.

The new device was placed in the hands of 10,000 rupture sufferers. They were amazed at its tininess and feather-like lightness. Soon the astonishing stories of the results received began to be reported.

One of the astonishing cases reported was a man 80 years old who had been ruptured for 50 years. His report showed that his rupture no longer handicaps him, which Mr. Buck terms "a remarkable achievement."



Another man, T. M. Connon, ruptured for years, reports that he takes part in athletics without fear of harm, and teaches boxing and wrestling after working long hours every day as a barber.

Relief at last—hundreds of rupture sufferers tell how Magic Dot System has brought back the enjoyment of life.

People in all sections of the civilized world have heard about the Magic Dot System and are sending to America for it. From every section of the Globe come reports telling of the astonishing results received.

Thousands of free samples of material, showing how an important part of Magic Dot System is made, have been given to rupture victims. The inventor also offers newest Efficiency Model on 10-day Trial by Actual Wear to all ruptured who mail the coupon.

Free Sample of Material and 10 Days' Trial Offer

Once a rupture victim tries this amazing comfort system, he usually never wants to return to cruel pressing devices of any sort. Hence this amazing offer of newest Efficiency Model—10 days' trial by actual wear. Mail coupon for full details. John G. Homan, New Science Institute, 2179 Clay Street, Steubenville, Ohio.

John G. Homan,
New Science Institute,
2179 Clay St., Steubenville, Ohio

Send me full details of your 10-Day Trial By Actual Wear offer on your newest Efficiency Model—also free sample of the "button rupture" material. This does not obligate me.

Name.....

Address.....

City.....State.....

Here is Edwin McTeer (address on request) and some of his work. The crude pen drawing was made before he had any training and the striking story illustration (worth $100) was made after he took the Federal Home Study Course.

He did it—Why don't you?

Edwin McTeer is only one of the hundreds of young men (and young women, too) who are succeeding in commercial art with the help of the practical training offered by the Federal Home Study Course. Well trained artists earn $50, $75, $100, $150 a week and more.

Success In Commercial Art

begins with a liking for drawing and the ambition to follow through with the right training. Mr. McTeer was thirty years old when he clipped a coupon like the one at the bottom of this ad, and took up the Federal Course. He progressed rapidly, increasing his earnings each year until at the end of five years he was making around $10,000 a year. Read what he wrote us:

"I was not very talented when I entered this training with you people as you certainly know, and I had not even had high school training and I know any one with a love for the work can accomplish even more than I if they will just let you people, the Federal Schools, help them.

"I suppose you remember I opened my own independent commercial art studio, and to make a long story short, my earnings are now at the rate of over $10,000.00 a year."

Send For "Your Future"

If you like to draw—send for book "Your Future" and find out what amazing progress you can make with the right art training. Use the coupon now, giving age and occupation.

Federal School of Commercial Designing

Dept. D, Federal Schools Bldg.
Minneapolis, Minnesota.

Please send me "Your Future."

Name.....

Age..... Present Occupation.....

Address.....

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SPEEDLIGHT COMPANY
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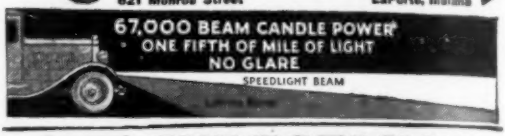

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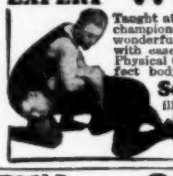

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No "if or ands" about it—you can make big money as soon as you can qualify through Sweeney Training for the good jobs now open.

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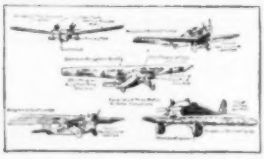

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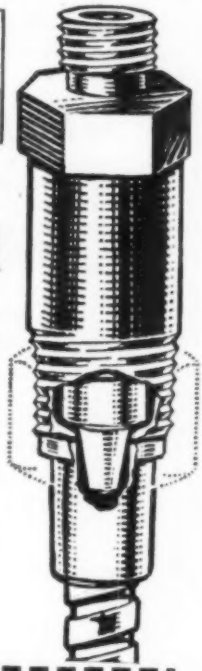

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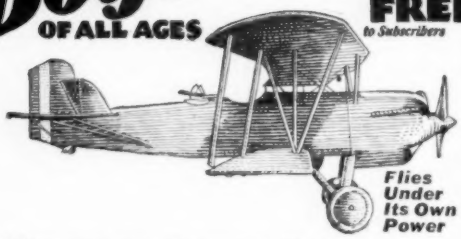

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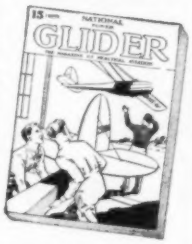

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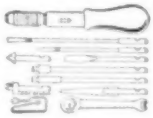
"Yankee" No. 1530 Ratchet Hand Drill (above), and No. 1555 Ratchet Breast Drill are fine gifts for motorists. These drills have five ratchet adjustments; they work where others can't. Price: No. 1530, $5.25; No. 1555, $11.00.



"Yankee" Tool Set No. 105 — ratchet tool holder with nine attachments. For the man who works on radio and home electric appliances. Price, $3.25.

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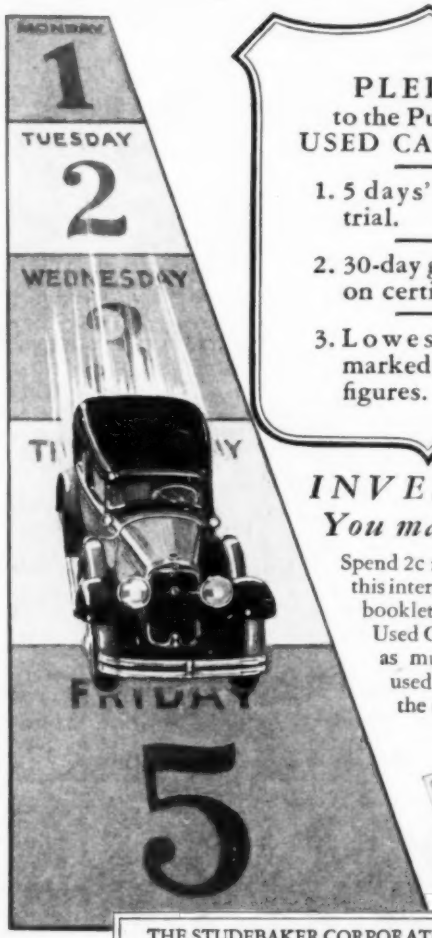

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A.C. Gilbert

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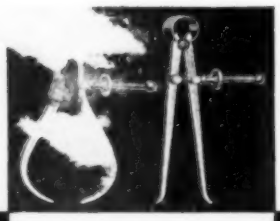

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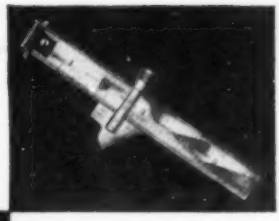
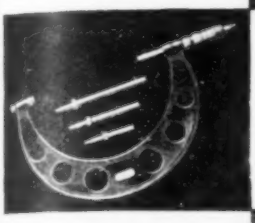
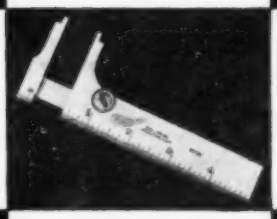
No. 22C—combines drill point gage, hook rule, plain rule, depth gage, try square, slide caliper—a handy, accurate tool.



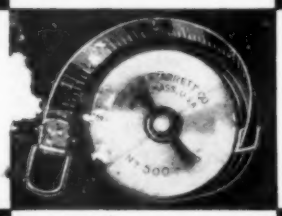


Micrometer
No. 224-AA—four interchangeable anvils—range of 0 to 4 inches by thousandths—decimal equivalents on thimble—black enamel frame.



Slide Caliper
No. 425—inside and outside measurements—thumb lock—graduated in 32nds and 64ths—furnished in 3" or 5" sizes—fits pocket

Pocket Tape
No. 500—furnished in 3, 5, 6, 8, and 10-ft. lengths, graduated in inches and 16ths—nickel plated case—rounded edges.



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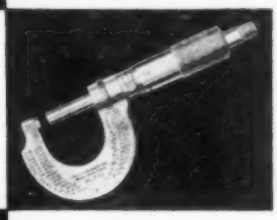
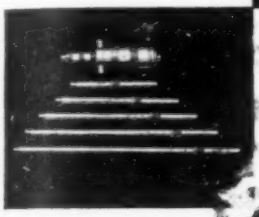
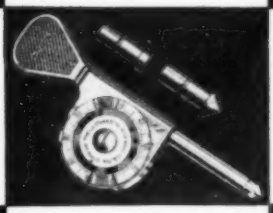
No. 230—cut-away frame—lock nut and ratchet stop—range of 0 to 1 inch in thousandths—finest accuracy and feel.





Inside Micrometer
124-A—six interchangeable rods—inside measurements from 2 to 8" by thousandths—lock screw—may be furnished with handle.



Speed Indicator
No. 104—determines r. p. m. of shafting, etc.—frictionless bearing—two extra rubber spindle tips—accurate at any speed.

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No. 436—moderate price—black enamel frame—equivalents on thimble—may be furnished with or without lock-nut and ratchet stop.

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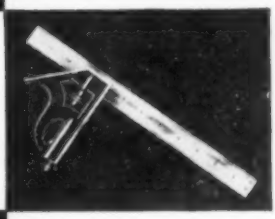
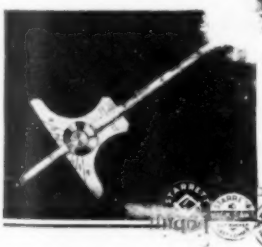
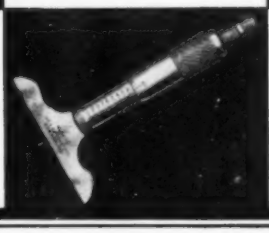




Depth Gage-Hook Rule
No. 236H—combines hook rule, depth gage, caliper, and handy protractor—graduated 32nds and 64ths—inexpensive and handy tool.



Micrometer Depth Gage
No. 440A—three interchangeable rods give range of 0 to 3 inches by 1000ths—with or without ratchet stop—a splendid tool of finest accuracy.

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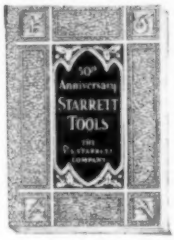

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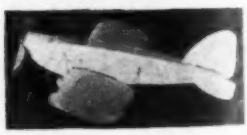

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New all-balsa construction makes this model lighter, stronger, better-looking and far easier to build. Everything marked. Nothing to draw or measure. No tools or skill required. Set includes die-stamped aluminum propeller, disc wheels, rubber motor, quick-drying cement, balsa, clear directions and all other material. Nothing else to buy. Complete set, postpaid in U. S. and Canada, $1.00. Satisfaction or money back. Order now.

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No catalogue except with set.)

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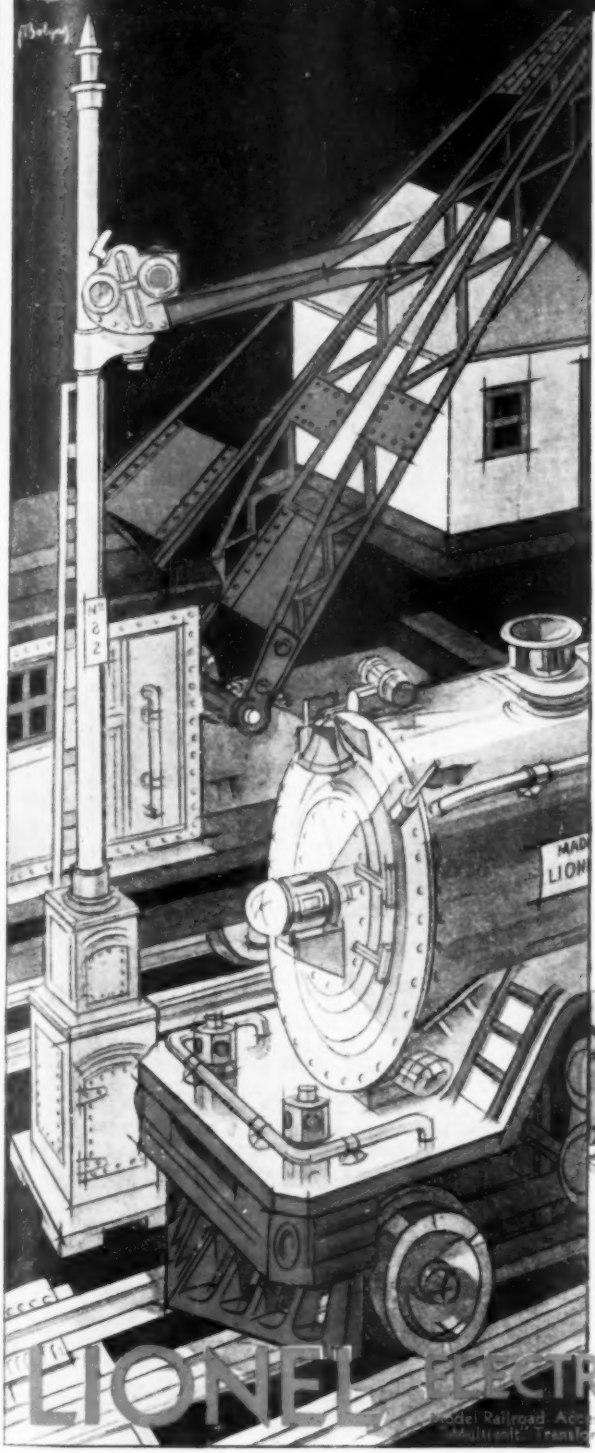

TELL Dad all about Lionel trains—point out to him the difference. Show him how real and life-like they are in appearance. Tell him why they are swifter, more powerful than any other trains.

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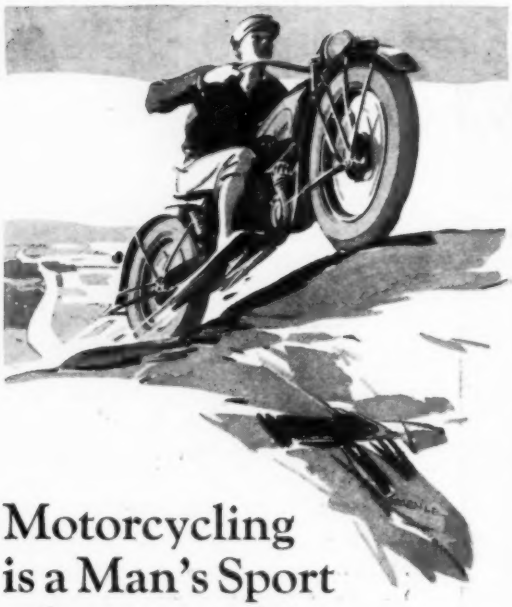

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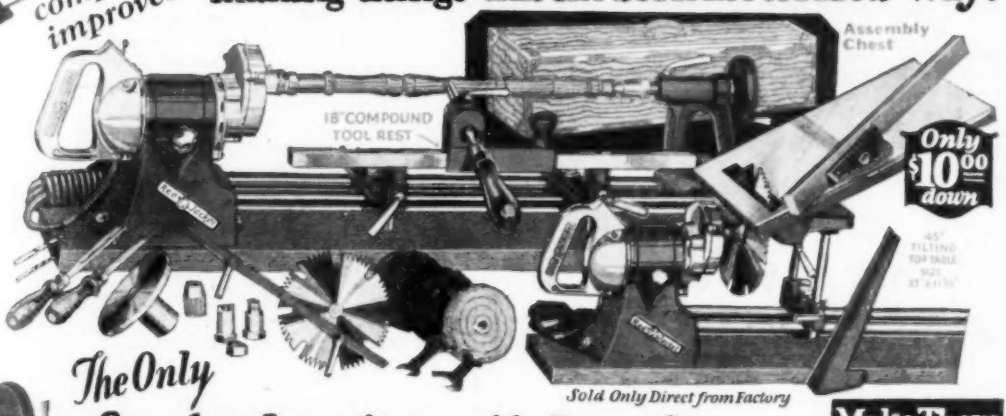
You'll prefer this Red Jacket compact—improved

Enjoy the thrill of your new skill in making things this modern *motorized* way!



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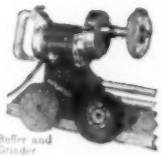
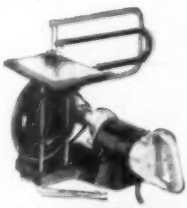


Buffer and Grinder Assembly



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Red Jacket Equipment is designed, tested, approved and guaranteed by Wm. L. Aylward, a nationally known craftsman and manufacturer who has developed his own life's hobby into a cooperative association of thousands of amateur and professional craftsmen. He invites you to join. He will instruct, guide and help you. A new zest in doing things awaits you.

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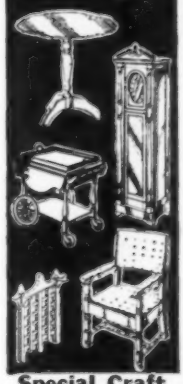

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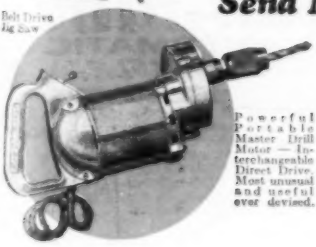

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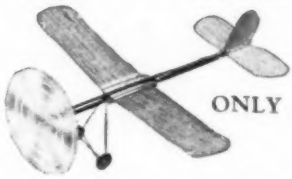

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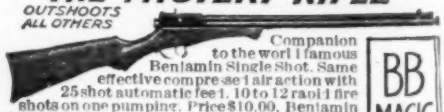

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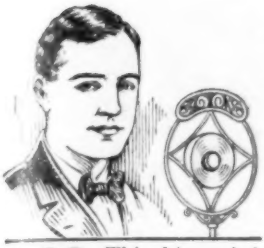

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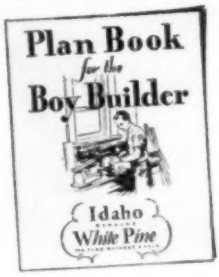

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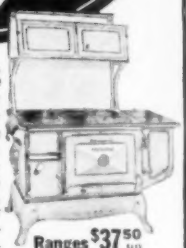

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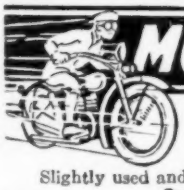

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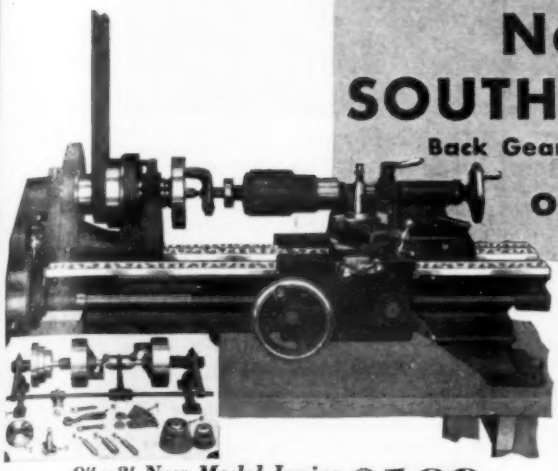

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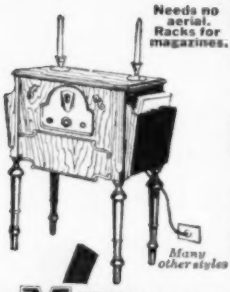

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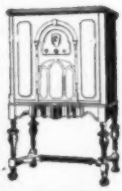

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TIME TESTED SINCE 1870

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Direct to you at wholesale prices

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Band Instrument and Case Co.
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$100 COACH MODEL FOR $4.98

THAT ANY SCHOOL BOY CAN BUILD IN A FEW HOURS

AN EXCELLENT CHRISTMAS GIFT—PROFITABLE PASTIME

Size: 24" long; 8" high; 6" wide.

We supply you with all the parts, cut to fit and ready to assemble, with a diagram and instruction sheet written so that anyone may easily follow. Each part is numbered and the corresponding numbers on the diagram show you just where to place them. No tools are needed except a small tack hammer. Beside the model of the George Washington Coach illustrated at left we have parts for the following: **Tally-Ho; Devonport to London coach; Deadwood stage coach, Covered wagon . . .** at $4.98 each (*less horses*).

Guarantee: If after assembling our coach model according to our instructions you are not satisfied, return it to us and we will immediately refund your money. You to be the sole judge.

Realizing the demand for coach models but that the prices charged by exclusive stores are too high for most people, we have made it possible for everyone to own one or more of these early conveyances which helped write the country's history.

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Sirs: Please send me complete parts, cut to fit and ready to put together for:

George Washington Coach ☐; Tally-Ho ☐; Devonport to London Coach ☐; Deadwood Coach ☐; Covered Wagon ☐; Send me FREE CATALOG ☐

I agree to pay the postman $4.98 plus postage. Foreign orders to be accompanied by U. S. money order or check.

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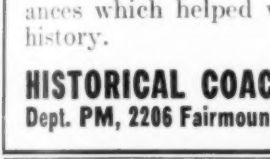
Make Your FORD Into The "ACE"

GET READY FOR SPRING—BUILD YOUR ACE NOW—

$5.99 Red-i-Kut life size patterns *Class—Snap*



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Famous sure-fit *RED-I-KUT* life-size patterns and picture instructions show how you can easily convert your Ford into this **Fast, Saucy, Sport**-Car as thousands have done with easily obtained materials. No need to lay up the car. Makes wonderful 4-passenger car. *Send 10c coin for actual photo of sport car and new manual of distinctive sport car patterns from $5.80 up—"RKO" Steel "Swing-Lo" irons. Tops, Windshields and many speed necessities. ORDER RIGHT NOW and get a real thrill.*

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AT ALL STORES

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Send for FREE Catalog

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50¢

Finest little ship you ever saw; flies with the best of them! 20 in. Wing-span, full-fuselage Cabin type. Made of Readi-cut Balsawood (not cardboard) with built-up wings, formed balsa propeller with nosing, wood wheels, finished metal parts—everything ready for construction. Demountable wings; weighs 1 oz. complete. It's a beauty and a GREAT Flier! Get yours now!

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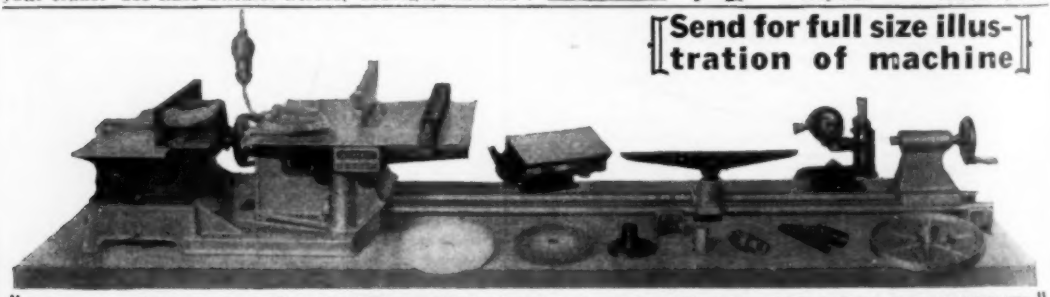
Send for full size illustration of machine



New Model WORKACE WOODWORKER

COMPLETE 5 FT. ELECTRIC WOODSHOP FOR HOBBY OR INCOME

FREE JIG SAW & GUARDS
$14.00 worth of extra value free if you act quickly.

Make hundreds of things with the Workace Electric Woodworker. Under the magic of the saw, planer, jig saw, lathe, sander, drill, grinder and buffing wheel (all included in the Workace Woodworker) raw lumber is easily converted into furniture, household necessities and countless other articles. Work out your ideas with your own complete electric workshop for fun or profit.

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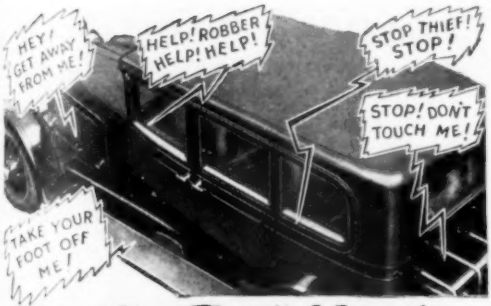

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Protects Your Car from Thieves

...Automatically!

THIS unquestionably is the queerest, most incredible invention since the first discoveries of radio! A magical, automatic watchman that actually is far more than human! Never sleeps, rests or gets tired! Stands guard over your entire car from spare tire to headlights and steering wheel! Endorsed by police! Approved by Motor Associations! Now offered on generous 5-day free-test basis!

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"What makes it work?" "Where on earth did you get it?" "Bet you five dollars he's got someone hiding in there!" "It simply can't be true." A running fire of comment like this breaks out whenever and wherever this new invention is exhibited. And why not? When no one ever heard of such a startling, uncanny device before! In fact few people would even dare to dream there could be such a thing! So this, men, is something really NEW, something to grip the imagination of everyone, something that sells to every autoist on sheer novelty alone. Distributors, "star" salesmen, every man who wants to double and triple his present income should note carefully the above facts.

A Mere Handful

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Write Today for Free Money Making and Sample Offer

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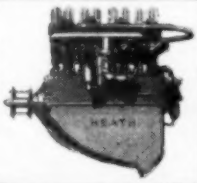

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Have your own fine paying business! Steady, repeat customers will soon help you build a permanent, profitable clientele. Easy to get started in spare time. J. W. Cremeans writes, "I have a Foley Filer and it is a money-maker."

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Files Hand, Band and Circular Saws

This ONE machine files all kinds of saws better than the most expert hand filer. It evens all teeth at the same time it files, **automatically.** Foley-filed saws cut better and faster, and stay sharp longer.

No Experience Necessary

Easy and simple to operate. With just a little practice, you can turn out perfectly filed saws. FREE PLAN helps you get started. Send coupon for complete information.

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A complete outfit includes 8" cast iron circular saw, 4" cast iron planer, 3-speed 6" x 36" lathe with angle steel adjustable bed, boring attachment, emery wheel, buffing wheel, sand disc and ⅓ H. P. motor mounted on sliding base. All machines completely guarded. Priced complete with motor.

Send coupon for descriptive circular.

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12" Band Saw
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Without motor, base and guard

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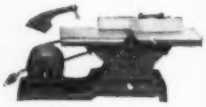

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Good woodworking machines since 1887
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Name.....City.....
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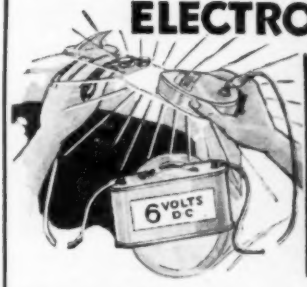

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Also Electrically Plates Brass, Copper, Silver, Gold, Etc.

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BETTER Practical GIFTS for *Christmas*

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H. Gerstner & Sons
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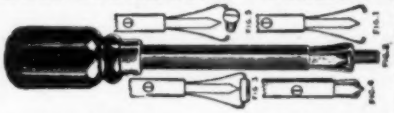
COX HOLDFAST SCREW DRIVER



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PROTECT YOUR TOOLS FROM THEFT

Write with electricity any name or design on the hardest and finest tools and instruments, or any metal, like writing on paper with pen or pencil.

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Interesting illustrated circular free. Write today. Agents wanted.

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METAL IN PASTE FORM

The only convenient metal solder

Every Electrical Connection needs Solderall for perfect reception

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Diam. 2" Wt. 2¼ oz.

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IS COILED A SIX-FOOT STEEL RULE!

Sounds unbelievable, doesn't it? But your hardware dealer will gladly demonstrate other unique qualities of this most remarkable of all modern tool inventions.

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Write to factory for booklet and six-inch sample

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12" Band Saw

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9" Swing 30" between centers

A REAL LATHE For School, Home or Factory.

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THE BIGGEST LITTLE TOOL EVER BUILT

18" clear swing

Not just a down payment—but the whole cost of this sturdy, powerful, smooth running jig saw. Requires only ¼ horse motor. Why fool with miniatures when this 18" job with 9" tilting table and strong one piece frame costs no more.

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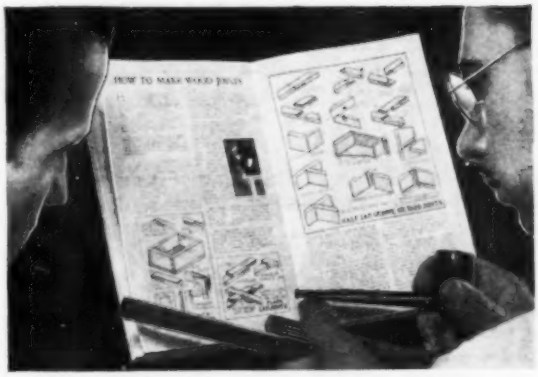

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"THIS new ATKINS Book, with simple directions and clear diagrams, makes it easy for me to do projects requiring accurate joinery—those I used to pass up. Now I can cut and fit dado, dovetail or dowel joints like an expert."

Saving shoulder of half splice joint with ATKINS Silver Steel Back Saw No. 2.

This "home workshop manual" also gives helpful hints on starting a shop, selecting the best saws and tools, and keeping them properly; shows you how to build a pair of handy saw horses, a better work bench, and a new tool cabinet. Next, a complete reference list of job plans for over 200 articles. Finally, a section showing scores of the world famous ATKINS Silver Steel Saws and Saw Tools, so that you can decide which ones you want and then see them at your hardware store.

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NEW TOOL VALUE

An Automatic Push Drill Carrying in the Handle Eight Sizes of Drill Points

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Pick out the size drill you want from the separate numbered compartment. Insert it in the steel jaws. Place drill point where you want hole. Push —push—and presto, you have a smooth clean hole. The handiest tool ever invented for household use. Made by one of America's leading makers of fine tools. Show this ad to your dealer and secure drill for $1.25 or mail coupon to us and drill will be sent postpaid c. o. d. $1.40.

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Please send me a No. 188 Automatic Drill. I will pay postman $1.40.

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Nothing under $2.00 ever bought such a good tool!

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for 2 colors enamel, any 3 or 4 letters & dates

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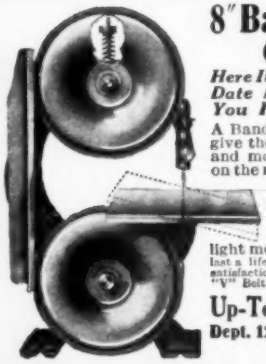

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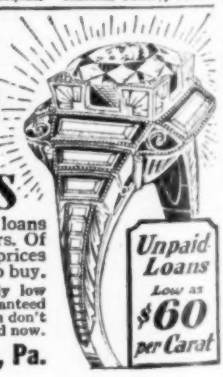

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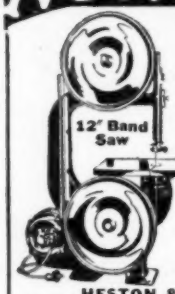

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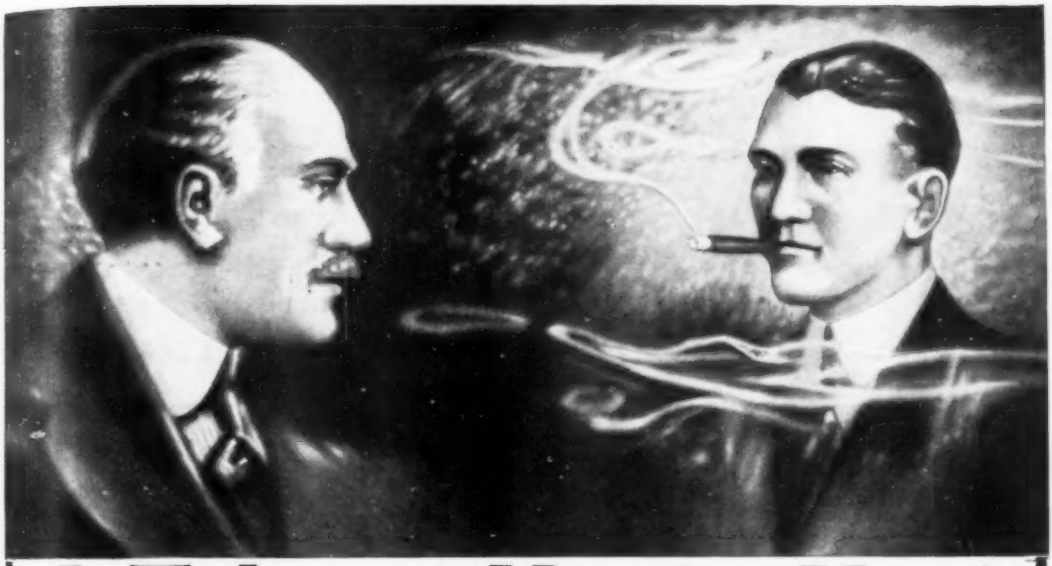

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That is because you haven't as yet, perhaps, felt the effects of the nicotine poison in YOUR system. For **you** know that nicotine, as absorbed into the system through smoking and chewing tobacco, is a slow working poison. Slow, yes—but **sure.**

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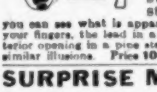

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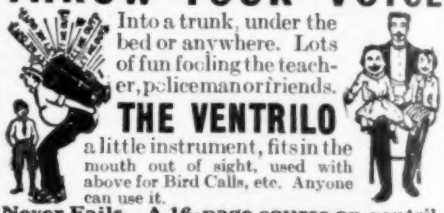

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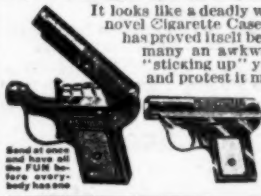

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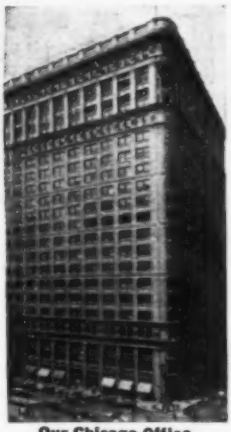

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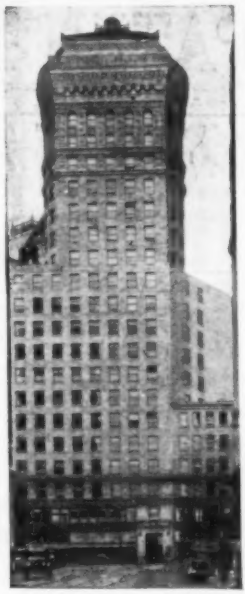

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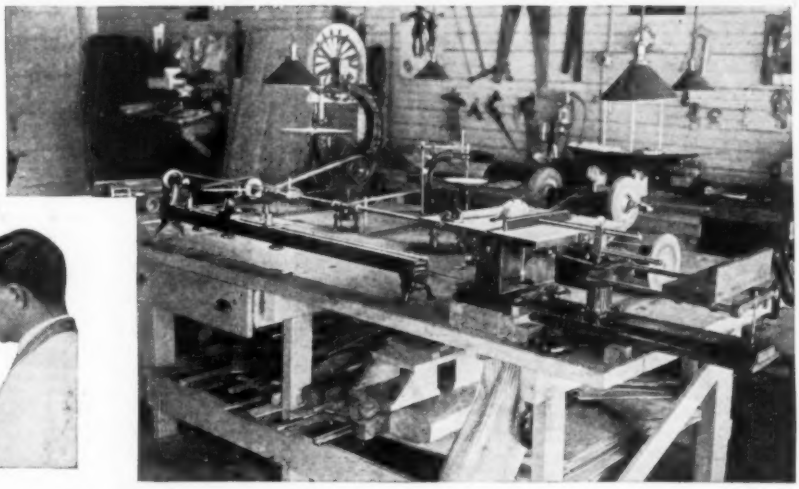

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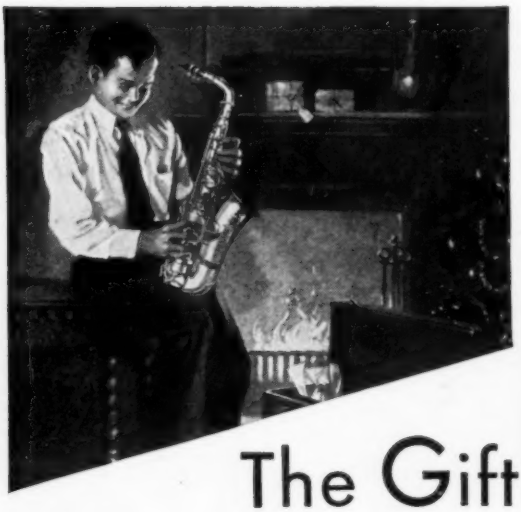

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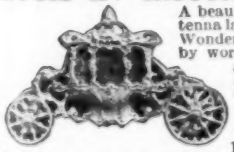

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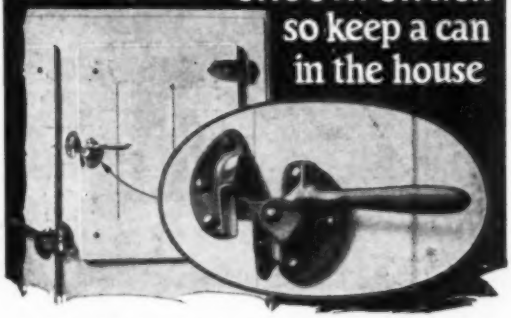

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Costs only $2.50 each, yet does work of $300 machine. Not a Toy but a real adding machine that everyone should carry. Made of steel and indestructible. Million dollar capacity. Fits in pocket. Weighs 8 ounces. Will not make mistakes. So simple child can operate. Instructions furnished. Be modern in dealing with figures—order your machine today.

Free Trial

SEND NO MONEY—

Just name and address. We will ship Calculator immediately. On delivery pay postman $2.50 (Plus few cents Postage.) (If outside U. S. send cash.) 10c additional in Leatherette Case. If not satisfied after 10 day trial you get your money back. THOUSANDS OF SATISFIED USERS.

This is the lowest priced practical calculator made. "Why pay more for inferior imitations?" Order from this ad.

Mail Coupon Today

BABY CALCULATOR MACHINE CO. (Manufacturers)
Dept. 71, P. O. Box 1118, CHICAGO, ILL., U. S. A.

☐ I am enclosing $2.50—send adding machine prepaid.
☐ Send Adding Machine C. O. D. $2.50 plus 18c postage. (10c additional in Leatherette Case)

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AGENTS Write for big commission and territory proposition.

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is soothing to your stump—strong, cool, neat, light. Easy payments. Braces for all deformities.

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"5 New Delights for Men"

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Send for "City of New York," true scale model, with hull sanded, decks attached, 33" overall. Includes blueprint, wheels, binnacle, propeller, ladders, mast and spar wood, line, chocks, bitts, blocks. Mail 15c for details and catalog.

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ONLY $6.45

Span the World with this Set!

A new radio thrill for you! Listen in DIRECT to London, Paris, Berlin, Buenos Aires and other broadcasting stations throughout the world via short waves. Enjoy unique foreign programs from strange lands. Your ordinary receiver cannot tune in these low wave stations. WORLD-WIDE RECEIVER gets 14 to 550 meter stations with surprising clarity. **SEND NO MONEY!** Just write your name and address on a postcard and ask us to send you this wonderful guaranteed short wave set. Pay postman $6.45 plus a small delivery charge. All orders west of Rockies must be accompanied by $1.00 deposit. Foreign countries $2.00 extra, postpaid. Write today for our parts catalog.

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RELIEVES PAIN QUICKLY

Have You a Troublesome Ailment?

INFRA-RED RAY LAMP

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giving full information on Infra-Red Ray treatments in your own home. For relieving neuralgia, sore throat, bronchial trouble, neuritis, sinus trouble, catarrh, asthma, rheumatism, tonsilitis, lumbago, and other ailments due to congestion. Infra-Red Rays penetrate deeply and restore active blood circulation. Quickly remove congestion. May be used safely by anyone. Attach to any light socket. Sent on approval, 5 days' trial. Write for catalog. **WM. CAMPBELL CO. Dept. 1040, Alliance, O.**

STEINER COMBINATION WOODWORKER $45.00

Belt Sander, Saw, Grinder, Drill

Pats. Pendg.

Has ¼ H. P. Motor, switch, cord and plug. 3x24 in. sander, 6-in. adjustable saw, 5 x ½ in. grinder for any tool or drill. Takes up to ¼ in. drills. Operates many other tools. Bronze bearings endless belt, polished table. Size 20x20. Weight 60 lbs. Highest grade—lowest price. Satisfaction guaranteed. Order now or write for circular P.

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Dandy Xmas Gift 20c each lineal foot

MASTER INTERLOX SLIDE RULE

Every kind of **Inside** Measurement. Just slide out the MASTER till it reaches from stop to stop. No guessing. Quick results. Locks rigid in use. Without equal for **Outside** measure, too.

Dealers and Agents Wanted

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A CLIPPER SHIP FOR $4.50

We supply all the necessary parts, cut and numbered, ready to put together. Instructions show full details how each numbered part fits into another. You can't go wrong. A few hours of pleasant pastime and you have a beautiful ship model. We also supply parts for the Santa Maria, the La Pinta, the Mayflower for $4.50, and Flying Cloud, for $4.50. Constitution (Old Ironsides) $5.98.

ALSO COACH MODELS for $4.98 AND MINIATURE GOLF SETS IN KNOCKDOWN FORM (shown in our new catalog). Models sent C. O. D. plus a few cents postage. Foreign orders must be accompanied by U. S. money order or check.

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Please send me complete parts, cut to fit and ready to put together for the following: Clipper ship [ ]; Flying Cloud [ ]; Constitution [ ]; Santa Maria [ ]; La Pinta [ ]; Mayflower [ ]; Coach Model [ ]; Miniature Golf Set [ ]. Please send me information pertaining to.....
Name.....
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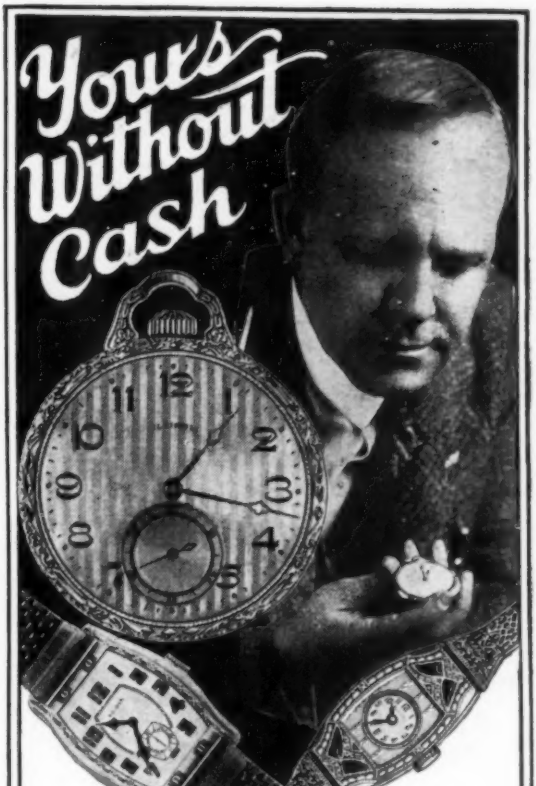
Yours Without Cash



Lone Eagle $37.50

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SEND NO CASH!—Just Mail Coupon! Nationally advertised Cash Price on Liberal Credit—and you can wear your jewelry without delay! Order now for Christmas!

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Let us send you our beautiful watch catalogue showing the Famous Santa Fe Mogul Railroad Watch, and the 21-jewel Santa Fe Special in both 16 and 12 sizes. Also the new 60 hour Bunn Special. Catalogue sent FREE.

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Write for our New Diamond Ring of Romance and Bulova Wrist Watch Catalogue showing marvelous new designs. Never have we been able to offer such beautiful diamond rings and artistic dependable watches at such low prices. The catalogue is sent FREE!

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SANTA FE WATCH COMPANY
Dept. C-6, Thomas Bldg. TOPEKA, KANSAS

To SANTA FE WATCH CO.,
Dept. C-6, Thomas Bldg., Topeka, Kansas

Please send me articles I have checked:
"Miss America" ☐ "Lone Eagle" ☐ or "Santa Fe Chief" watch ☐ as featured in your advertisement. Send me watch catalogue ☐ Diamond Catalogue ☐. Catalogues sent FREE. Postage Prepaid.

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Address.....City.....

The WORLD'S LARGEST RADIO STORE

Practically everything in Radio—including all the latest 1931 features—is listed in our cut-sale catalog just out. We have slashed the prices on all sets and equipment, passing along to you the marvelous price-savings made possible by the buying power of the World's Largest Radio Store.

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You reap the benefit of lowest wholesale prices on New Humless, Screen Grid A. C. sets, battery operated sets, beautiful and artistic consoles, dynamic speakers and phono-combinations, tubes, parts, kits and all kinds of accessories. The prices are almost unbelievable.

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We are nationally known as the lowest priced of all reliable Radio houses, and we frankly state we have never before offered such values. Send today for this catalog of smashing bargains, and save money on all your radio supplies.

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A New Business in Your Town.

$3000. PROFITS IN FOUR MONTHS by Geo. Alexander, Pennsylvania.

A delightful, dignified and fascinating business. Make and sell Crispettes. Delicious confection. Young and old like them. Come again and again for more. Easy to make. I supply everything. Raw material plentiful and cheap. Profits big. No town too small. Start now.

Quick Success Possible anywhere—cities, towns, villages; open a little retail store; or, begin at home; wholesale to stores, grocers, bakers, druggists, parks, baseball games, picnics, wayside stands.

Exceptional (not average) Profits—$11,265 sales in 3 months reported by California man. New Jersey $4,000 profits in less than two months. Revel of Michigan wrote: "Made $25 on my first day." A. Leib of Montreal wrote: "My sales averaged $400 per week."

We Start You in Business for little money. Supply machines, secret formulas, and raw material. Little capital starts you. No experience needed.

Write for "Book of Facts"—it's free, contains success letters from others—shows their places of business, tells how to start.

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AGENTS! SELLS LIKE WILD FIRE

New improved window washer eliminates all muss wherever there is glass to be cleaned. Approved by Good Housekeeping and Household Searchlight. Restricted territory. *Write today.*
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The Best Christmas Gifts

Deluxe flying models and building kits, from 50c to $11.50. *Boy Scouts of America Official Kits.* Junior Air Service Ground Course of 50 Booklets, with 2000 pictures, teaching all about Aviation—$24.50 per set.

Catalog 5c

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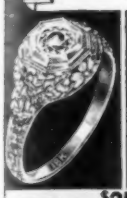
XMAS GIFTS Your Choice Sent For $1.00

10 MONTHS TO PAY



Direct diamond importations and large volume sales make possible these unusual values in perfect, genuine blue-white diamonds and standard watches.

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Send only $1. with order and your choice comes to you on **10 days' free trial**—no C. O. D. to pay on arrival. No interest—no red tape. After examination take 10 months to pay balance. Satisfaction absolutely guaranteed or money back.

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$37.50

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EO 5 . . . Guaranteed **IT'S A BULOVA** 15-jewel Gent's **Bulova** watch. White gold filled case, "dust-tite" protector; radium dial and hands; woven mesh wrist band. Only $2.88 a Mo.

Catalogue FREE to Adults

New catalog of genuine diamonds—Bulova, Elgin, Waltham, Hamilton, Howard Illinois watches; fine jewelry, silverware, special prices. Write now for Free Copy.

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winding models show winding and connections in plain sight. Make your own or rewind motors for your own use or for profit. In use all over the world. Quick, easy way. Write Dept. DPM, Send dime for circulars.

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Modern Design . . Quality Built . . Moderately Priced . .

For Factories . . Schools . . Amateur Work Shops

We build:

Band Saws	Disk Grinders
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Universal Variety Saws	Universal Wood Workers

High efficiency, accuracy, simplicity, safety, economy of operation are outstanding features of Crescent Machines. Portable machines operate from light socket. Big line of machinery for heavy production work in factories. Send for our interesting bulletins, well illustrated, clearly written.

The Crescent Machine Co., 93 Columbia St., Leetonia, O.

SICK OF BLADE PROMISES?

Send for **DOC DURHAM** *with his hollow ground Blade*

GO AHEAD—if you must. Try every blessed razor and blade on the market. Then, when your head's in a whirl, let Durham-Duplex blades restore your faith in humanity and give you something to swear by, not at.

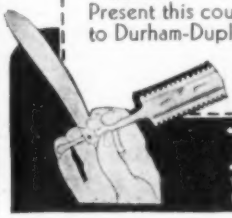
Durham-Duplex blades are better now than ever. The latest output are a revelation in long-lasting keenness. Their hollow-ground edges are the finest in over twenty years . . . and that's saying plenty!

Package of 5 Blades 50c or get a razor and one blade for a quarter at your dealers or DURHAM-DUPLEX RAZOR CO., Jersey City, New Jersey. Canadian address 50 Pearl Street, Toronto.

Name.....

Address.....

Present this coupon to your dealer or send to Durham-Duplex Razor Co., Jersey City, N. J. with 25c and get a genuine Durham-Duplex razor and blade.



DURHAM-DUPLEX

THE RAZOR WITH THE BLADES MEN SWEAR BY—NOT AT

A CHRISTMAS TIP FOR DAD

MAYBE Dad doesn't know how you have your heart set on an instrument for Christmas. Maybe he doesn't realize the fun and good fellowship you can get out of belonging to an orchestra or band—how you can earn extra spending money—how you may even get started on a pleasant, well paying and successful career through being able to play.

Of course you don't like to tell him outright that a **KING** would make you the finest kind of a Christmas present. Well, if he should "happen" to read this advertisement you would probably find just the instrument you want under the old tree on Christmas morning.

You can fix it so he'll read this. Then he'll know that a King is sold on **easy payment terms** and on **ten days' free trial** if desired. Cleveland and American Standard instruments—lower in price—are sold on the same convenient terms. Write for **new combined catalog**, featuring three popular lines, and special folder on the particular instrument you are interested in.

KING For a Day Forever

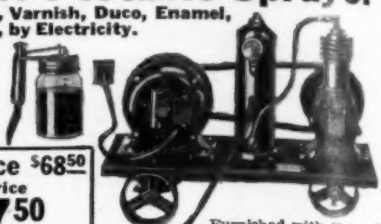
THE H. N. WHITE CO.
5212-78 Superior Ave., Cleveland, Ohio
Makers of KING, Cleveland and American Standard Band Instruments.
Wide Range of Prices to Meet All Requirements

The H. N. White Co.,
5212-78 Superior Ave., Dept. 4-B, Cleveland, Ohio
Kindly send me new combined catalog and full information.
Instrument I am interested in.....
Name.....
Address.....
City.....*State*.....

Electric Portable Sprayer

Sprays Paint, Varnish, Duco, Enamel, Lacquer, etc., by Electricity.

Attach to light socket, turn on switch and paint the power way. Does work of 5 men.



Reg. Price $68.50
our Price
$27.50
without Motor

Furnished with General Electric motor for $39.50. Nothing else to buy.

Has Kellogg air cooled compressor that operates spray gun continuously at 30 to 40-pound pressure. Outfit includes air filter tank pressure gauge, pop-off valve, connectors, 12 feet of hose and spray gun. Entire outfit mounted on all steel base on 3 steel wheels Weight 70 lbs. Send $5.00 deposit with order—balance C. O. D. Write for circular.

NATIONAL JOBBING AND EXPORT CO.
192 N. Clark Street Dept. 11 CHICAGO, ILL.

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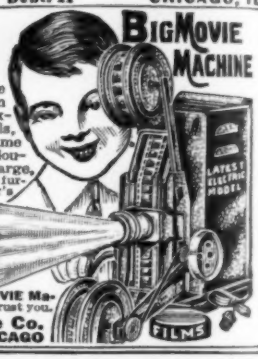

THIS Large Size Movie Machine operates on same principles as expensive professional models, uses standard size films same as big theatres. Imported double Convex Lenses show large, clear pictures. Complete outfit furnished—enough for a full hour's show, including Tom Mix film, etc. Easy to operate, guaranteed for life. Just send for 12 large Bottles *Salut D'Amour* Perfume that sells at 25cents each. *This is a real bottle size 2 x 2 inches.* We also send 12 Perfume Novelties which you give away free of charge and Easy Plans for obtaining **MOVIE Machine.** Send no money. We trust you.

TREVAUX Perfume Co.
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Play Golf in Your Own Home All Year for 35c

A marvelous new golf hole. Makes carpet putting the same as a grass green. Have your own indoor course. Limitless possibilities for fun and improvement of putting. Year round entertainment at home. Everybody plays. Portable. One hole 35c; set of 4 holes packed in box $1.00. Prepaid. *Ideal Christmas Gift.*

H. & H. PRODUCTS COMPANY
4992 Melrose Ave., LOS ANGELES, CALIF.

Fastest Cutting

Saws 15 Cords a Day

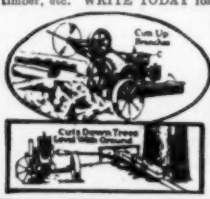
ONLY $39

Now—Get My Greatest Log Saw Offer

It's easier, now, than ever before to own this fastest-cutting, easiest-moved, most powerful Log Saw. Now, you can make big money sawing firewood, stave-bolts, ice, shingle timber, etc. WRITE TODAY for FULL DETAILS.

350 Cuts a Minute! Take any size log—in a few seconds it's all sawed up—without any hard work!

Puts the OTTAWA Working For You!



Try 30 DAYS OTTAWA
—ONE WHOLE MONTH to use the OTTAWA at your own sawing. Every saw shipped on trial.
Backed by 10-Year Guarantee

Make Big Money—Wood selling at $3 a cord brings owner $45.00 a day. Go into the wood business. Don't let the lack of ready money stop you—Remember, we sell on very easy terms.

To Save You Freight—and get your machine to you a few days after your order, I ship from factory or nearest to you of 4 BRANCH HOUSES.

FREE Send me your name and address on a postcard today for my wonderful new edition of the "Wood Sawing Encyclopedia." Be sure to investigate—it will help you to make big money.

FREE Wood Sawing Encyclopedia

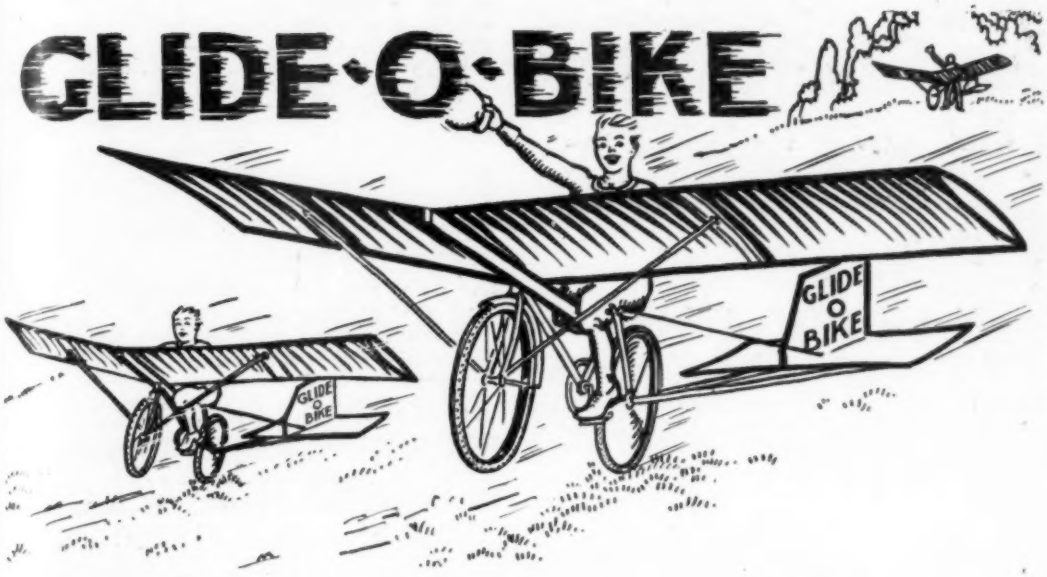
C. E. WARNER, Pres., **OTTAWA MFG. COMPANY**
1745-L Wood Street - - - Ottawa, Kansas

Prepaid $3.75 Ideal Xmas Gift

LIGHTWOOD COMPRESSED MODEL AIRPLANE MOTORS AND GLIDER GASOLINE ENGINES

Model Builders Handy Man Supplies, gears, materials, books, castings. 3,000 price listings. Illustrated Cat. No. 28—25c coin. Glider Engine Prices with Catalogue.

AMALGAMATED CORP. 605 Washington Blvd. CHICAGO, ILL.



Do You Have a Bike?

IF SO, you can soon have a Glide-O-Bike! Now, every boy can get the "feel" of the air. And at a reasonable cost. Quickly attached to, or detached from, an ordinary bicycle. The Glide-O-Bike will bank, stall, ground-loop, etc. Get the thrills of flying without leaving the ground. Its safety is readily seen, since only the front wheel leaves the ground when sufficient forward speed is attained, the rear wheel remaining on the ground for power. The first time in the history of aviation that so much fun is placed within the reach of everyone who rides a bicycle. An ideal Xmas gift for the air-minded boy.

Boys Make Money

Many boys are making big money by having a miniature Glide-O-Bike airport and getting 10c to 25c for each ride from other boys. In this way you can have plenty of spending money and lots of fun, too.

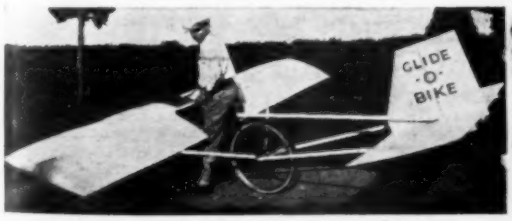
With each set of plans, you also get without additional cost, a long list of air terms every boy should know and full instructions how to start and operate your Glide-O-Bike airport. Start now and be the first in town to own one. You can make it in your back yard or work shop. Only a few simple tools are necessary. The logical step between model building and glider construction.

Construction Set

This set can be assembled in 2 or 3 hours. Has all of the difficult parts already shaped. After being once assembled, it is then quickly attached to your bicycle. Construction is of high grade materials and comes in combination colors of red and green. This makes a very attractive job. When you get it assembled, watch the crowds gather. Dozens of boys will want one.

Special factory price—only $25. f.o.b. Dallas, Texas, U. S. A.

Exclusive territory now available to reliable parties. State what territory wanted. Fail[illegible] act quickly may cause [illegible] tory. W[illegible]



(Above) The famous Nelson Glide-O-Bike, photos and descriptions of which have recently appeared in the leading scientific magazines of America and Germany.

EVERY TOOL IN SIGHT . . . IN REACH

What a tool box! All but hands you the tool you want. Trays automatically lift and spread out before you as lid is opened. Single motion closes everything. Deep drawn from lead coated steel; no seams; leak proof. Lid opens level with box, can't upset. Finished inside and out with a heavy coat of baked enamel, olive green. Strong, rust-proof lock. At your dealers or shipped postpaid upon receipt of price.

2 popular styles
Guaranteed to be as represented

No. 616. 16 inches long, 7 inches high, 6½ inches wide. Fitted with lock, rust proof. Two trays, as shown in the above illustration . . **$6.50**

No. 316. 16 inches long, 6⅛ inches high, 6½ inches wide, with only one tray. Finish and fittings are the same as the above **$5.25**

OUTING'S TOOL and TACKLE BOXES

MAIL THIS COUPON ➡

OUTING MANUFACTURING CO. 04
12 05 Jackson Street, Elkhart, Indiana

Please send me catalog-folder of your Automatic tackle and tool boxes.

My dealers' name is.....

My name is.....

Address.....

Town.....*State*.....

BILD-O-PLANE

Instructive and amusing construction set for building miniature scale model of the famous D-H 4B Army Bomber. These are the smallest scale models on the market for the price. Wing spread 13 inches. Complete including 3 inch hand carved wood propeller and aluminum exhaust pipes, nicely finished and painted. A real Xmas present for the boy.
Postpaid for One Dollar

Dept. 1. MONROE MODEL AIRCRAFT Fruitland Park, Florida

Name..... Address.....

AN INCOME BUILDER

two distinct lines in one. For either salesmen or those mechanically inclined.

$50.00 Value for $6.00

with profits accordingly large.

We can provide you with unlimited quantities of all leading makes of electric vacuum cleaners at sensationally low prices; each guaranteed perfect in action and appearance. Such extreme value and profit offers any man of average intelligence a splendid income even for spare time.

FREE VAC COURSE

To our associates we give in bound book form, free expert advice and seldom disclosed instructions in building and servicing all vacs. Through this free training you may readily develop a permanent, well-paying business all your own. From our immense resources we supply all needs. At trifling cost and no risk you can prosper with us, the originators. Oldest and largest in the line. Literature tells all.

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1302 ENGINEERS BUILDING, CLEVELAND, OHIO

Agents Making Up *to* $40.00 *a Day*

A $12.50 SUN LAMP *Sensation*

You can make a killing with this new Solray Health Lamp at $12.50. As powerful and beneficial as $90 lamps. Generates *both* ultra-violet and infra-red rays. Guaranteed. Everyone a prospect. Liberal commission. No competition. Write for details of

FREE **Trial Offer** by which you can get demonstrator lamp without risking a cent. Act quick! Write or wire

THE SOLRAY CO., Inc.
Dept. 1359, 217 E. Illinois St., Chicago

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of Popular Mechanics Magazine, published monthly at Chicago, Ill., for October 1st, 1930

State of Illinois, County of Cook, ss.
Before me, a notary public in and for the state and county aforesaid, personally appeared H. H. Windsor, Jr., who, having been duly sworn according to law, deposes and says that he is the editor and business manager of the Popular Mechanics Magazine and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit: First. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, Popular Mechanics Co., 200 East Ontario St., Chicago, Ill. Editor, H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill. Managing Editor, L. R. Weber, 200 East Ontario St., Chicago, Ill. Business Manager, H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill. Second. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) L. R. Windsor, 200 East Ontario St., Chicago, Ill.; H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill. Third. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. Fourth. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. H. H. WINDSOR, Jr., Editor and Publisher. Sworn to and subscribed before me this 29th day of September, 1930. J. GRAHAM, Notary Public. (My commission expires June 16, 1932.)

Start a Business of Your Own EARN $150. to $300. PROFIT MONTHLY

Filling Stations, Garages are all making big money with "8-Hour Battery Charging." Practically no investment. Any one can operate. Charges [illegible] current bill. Recommended by car and battery makers. Every

TRIAL—Pay out of Profit Terms

[illegible] built with HB 20-minute Car Washer, Test Bench Service, [illegible] Welding. HB won't cost you a cent. Easily pays for itself [illegible] handsome salary besides. Full particulars if you check the

[illegible]OTHERS, Box M120, Troy, Ohio.

HB PAINT SPRAY $20. MO.

HB TEST BENCH $16. MO.

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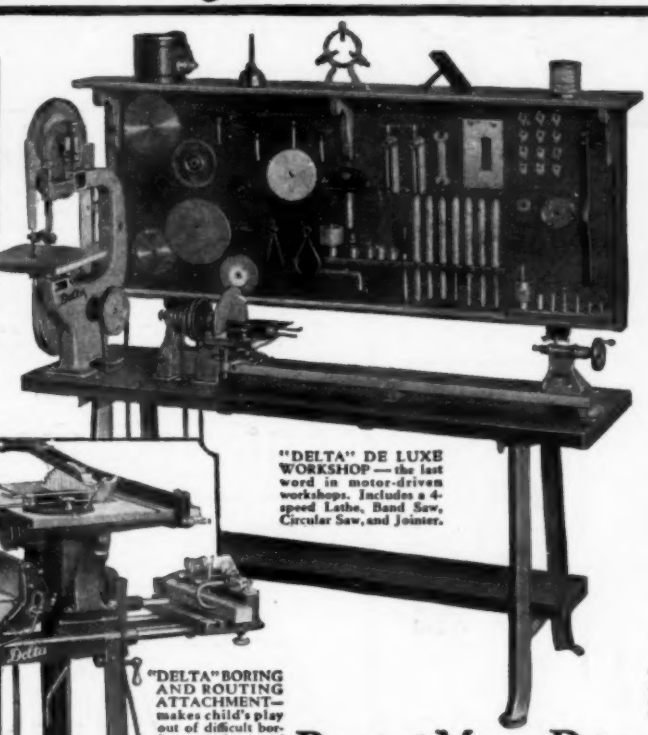
New Units, *New* Features, *New* Improvements in Complete 1931 "*Delta*" Woodworking Line

No more drudgery—no more tedious hand work when you use "Delta" motor-driven tools. Working with wood becomes a real pleasure with the help of these time-saving, efficient, practical machines.

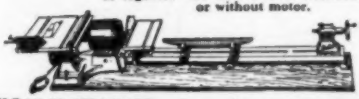


"DELTA" DE LUXE WORKSHOP—the last word in motor-driven workshops. Includes a 4-speed Lathe, Band Saw, Circular Saw, and Jointer.

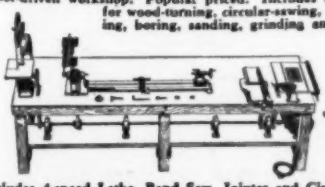
"DELTA" BAND SAW has many exclusive features. Provided with special extra-safe guard. Furnished with or without stand.

"DELTA" BORING AND ROUTING ATTACHMENT—makes child's play out of difficult boring, routing, and mortising. Convenient, easy to operate. Furnished separately if desired.

"DELTA" COMBINATION JOINTER and CIRCULAR SAW. Can be operated separately or together—no interference. Furnished with or without motor.



"DELTA" HANDI-SHOP—A complete, compact, practical motor-driven workshop. Popular priced. Includes equipment for wood-turning, circular-sawing, scroll-sawing, boring, sanding, grinding and buffing



"DELTA" LINE-SHAFT SHOP

Includes 4-speed Lathe, Band Saw, Jointer and Circular Saw. Operates with either gasoline or electric motor. Very efficient.

Practical Motor-Driven Woodworking Equipment Now Within Reach of All

Again "Delta" blazes the trail toward woodworking efficiency with the announcement of its new 1931 line! Now are available at astonishingly low price levels a complete series of compact, rugged woodworking machines incorporating numerous exclusive constructional features. Each unit embodies the practical, efficient design, the careful workmanship, the dependable quality of materials—for which the "Delta" trademark stands. The new "Delta" Boring and Routing Machine, the "De Luxe" Workshop, the new "Delta" Band Saw, as well as the improved "Handi-Shop" are but a few of the Delta Units that will be of intense interest to all those who work with wood. All units now operate with either electric or gasoline motor power.

Make Things Quickly and Easily With These Modern Motor-Driven Tools

They save time and labor, and produce better work for artisans, f[illegible] and mechanics. Up-to-date craftsmen everywhere are flock[illegible] driven woodworking equipment to eliminate [illegible] or spare-time work, "Delta" Uni[illegible]

10-[illegible]

EA[illegible]

Send [illegible] trate[illegible] new [illegible] tails o[illegible] Easy P[illegible]

DELTA [illegible]

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Sets - Kits Parts and Accessories at Lowest WHOLESALE Prices!

The new Allied Catalog brings you all the 1931 marvels of Radioland — Screen Grid, Tone Control, A. C. Humless all-electric sets, Mantel Sets, battery sets, slot machine radio, the new auto radio, beautiful consoles, dynamic speakers, and every known part and accessory.

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6 Months' Shaves From *ONE* Blade!

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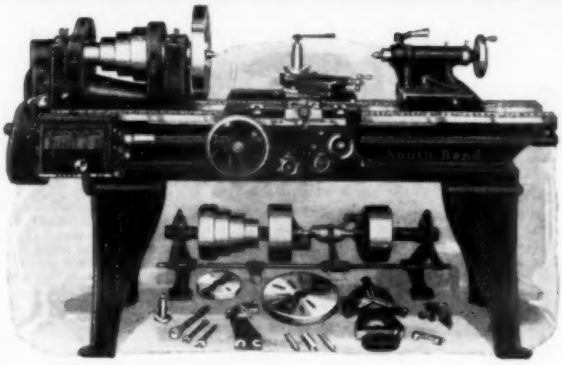
Canadian Office: 90 King Street West, Toronto

New Model SOUTH BEND LATHES

Back Geared Screw Cutting Precision Lathes

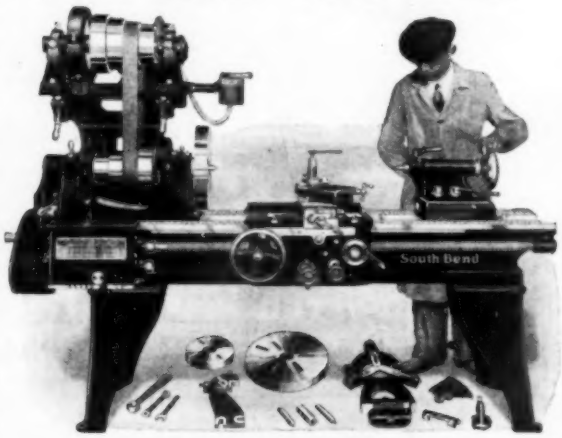
FOR EVERY INDUSTRIAL USE



16" x 6' Quick Change Gear New Model South Bend Lathe **$598**

Prices of Other Quick Change Gear Lathes

Size of Lathe	Shipping Weight	Countershaft Drive	Silent Chain Motor Drive
9" x 3'	490 lbs.	$294.00	$398.00
11" x 4'	725 lbs.	$359.00	$498.00
13" x 5'	1110 lbs.	$443.00	$602.00
15" x 6'	1550 lbs.	$543.00	$720.00
16" x 8'	2035 lbs.	$638.00	$817.00



18" x 8' Quick Change Gear Silent Chain Motor Driven Lathe with Motor and Equipment as shown . . . **$997**

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South Bend Lathe Works

630 E. Madison St., South Bend, Indiana, U.S.A.

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OUTSTANDING leaders in every field of American Industry use South Bend Lathes in production and tool room work. The new model South Bend Lathes are built in 96 sizes and types, 9" to 18" swing, 3' to 12' bed length—a type for every requirement.

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Write for These Books

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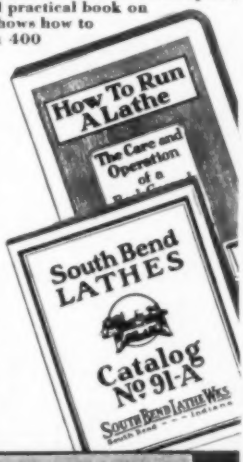
Latest edition of this famous work, contains 160 pages and more than 300 illustrations. Simplest, most complete and practical book on lathe operation. Shows how to handle more than 400 different types of lathe jobs as practiced in modern machine shops. Sent postpaid for only 25 cents; coin or stamps of any country accepted.

Catalog No. 91-A Free

This 104 page book illustrates, describes and prices the 96 different sizes and types of new model South Bend Lathes. Send coupon for your copy, free.



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"Yes, Betty, I've had another raise! Twenty dollars—think of it! That's a thousand more a year. We *can* have the new furniture now, dear, and save more than ever, besides. You certainly were right about that International Correspondence Schools Course. You said I'd make some headway, once I had the training. And studying at home in my spare time wasn't hard, either.

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"This is only the start, dear. Nobody can stop me now, for I've got the training to handle my job and the job ahead."

Thousands of I. C. S. students are earning promotion and increased pay through spare-time study. Your employer is watching you. If he sees you have the training for a bigger job, you'll get it.

One hour a day, spent with the I. C. S. in the quiet of your own home, will prepare you for success in the work you like best. Put it up to us to prove it.

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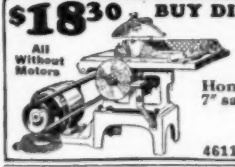
New Complete "Wonder" Workshop

$18.30 BUY DIRECT. SAVE 35% TO 50%



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12" Band Saw $29.25 to $37.05
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Home Workshop—11"-3 spd. lathe, 7" saw table, 8" scroll saw.....54.00

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$10.00 PER MONTH BUYS
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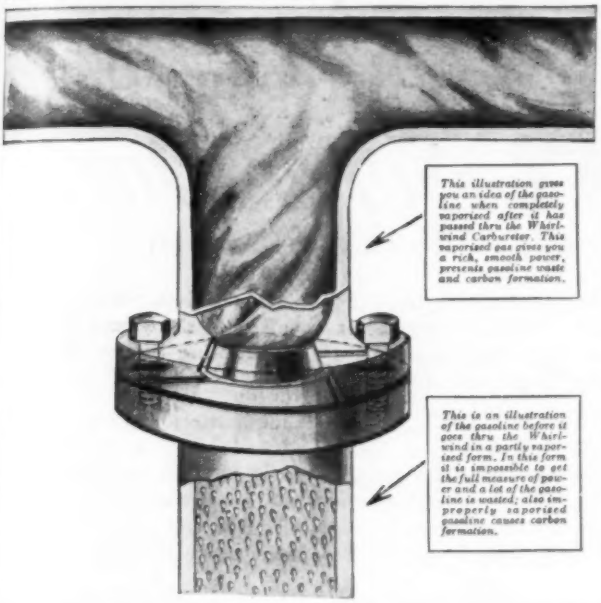
A new invention called the Whirlwind is actually saving millions of gallons of gasoline for automobile owners. Those who have installed this amazing device on their cars report almost unbelievable gasoline savings. They also report more speed and power, quicker starting and reduction of carbon.



The marvelous thing about this Whirlwind is that it works as well on all makes of cars. Reports are received from owners of practically every known make of automobile from Fords to Lincolns and they are all equally enthusiastic in their praise.

FITS ALL CARS

In just a few minutes the Whirlwind can be installed on any make of car, truck or tractor. It's actually less work than changing your oil or putting water in the battery. No drilling, tapping or changes of any kind necessary. It is guaranteed to work perfectly on any make of car, truck or tractor, large or small, new model or old model. The more you drive the more you will save.

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TO MAKE UP TO $100.00 PER WEEK

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Good territory still open. Sample offer and full particulars sent on request. Just check the coupon.

GUARANTEE

No matter what kind of a car you have—no matter how big a gas eater it is—the Whirlwind will save you money. We absolutely guarantee that the Whirlwind will more than save its cost in gasoline alone within 30 days, or the trial will cost you nothing. We invite you to test it at our risk and expense. You are to be the sole judge.

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Gentlemen: You may send me full particulars of your Whirlwind Carbureting device and tell me how I can get one free. This does not obligate me in any way whatever.

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The Best Short Wave Reception Unit

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You can tell a leader by how many followers he has. Pilot Super-Wasp's success is proved by its many imitators. Remember, Pilot Super-Wasp covers from 14 to 500 meters, giving you practically all the regular broadcasting channels as well as short waves. And don't overlook the fact that Pilot products are known *personally* to more users throughout the world than any others and that every single Pilot product is made in the largest factory in the world owned and operated by a radio manufacturer.

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$29.50

Kit K-110: The battery-operated Super-Wasp. Batteries and Tubes extra.

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